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UNITED STATES DEPARTMENT OF AGRICULTURE

Miscellaneous Publication No. 204

Washington, D. C.

Issued Angust 1935

RAINFALL INTENSITY-FREQUENCY DATA

By

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Division of Drainage, Bureau of Agricultural Engineering





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INTRODUCTION

The purpose of this investigation was to determine the frequency at which excessive rates of precipitation occur in different sections of the United States, and the intensity and duration of those rates. Such data are fundamental for the adequate and economical design of farm-terrace systems, farm-drainage systems, highway and railway culverts, municipal storm-sewer systems, and other engineering works that must care for storm run-off. It is believed that this study has developed data sufficient for predicting with reasonable accuracy the period of recurrence of intense precipitations in any part of the United States. The methods followed and the results obtained differ considerably from those of the Miami Conservancy District.³

From a detailed study of the records of excessive short-time precipitations at the Weather Bureau stations in continental United States having recording rain gages (see fig. 1), tables have been prepared showing for each station the short-interval record of the most intense storm and the maximum short-period precipitations that have occurred, and charts have been prepared showing the maximum precipitations in periods of 5 minutes to 2 hours that may be expected to occur with average frequencies of 2 to 100 years. From the same records and those of 24-hour precipitations at all Weather Bureau stations in continental United States, similar charts have been prepared showing the maximum 4-hour to 24-hour precipitations of

¹ The compilation, analysis, and publication of the data presented comprise a research project financed by funds provided by the Civil Works Administration, and carried out by temporary employees of the Bureau of Agricultural Engineering under the direction of the author.
² To Adolph F. Meyer, professor of hydraulic engineering, University of Iowa, the author is deeply grateful for extended advice and assistance in preparation of the rainfall charts. The suggestions also of Frederick Theodore Mavis, associate director in charge of the Laboratory of Hydraulic Research, University of Iowa, are acknowledged with thanks. Aid in the computations was given by engineers J. Alston Fisher, Walter Valentine, Edward Soucek, L. W. Garrett, Charles W. Kinney, Carlos Kampmeier, G. A. Kellow, F. W. Kunkel, R. B. Miller, J. W. Blessing, R. B. Day, and J. B. Saylor.
³ MIAMI CONSERVANCY DISTRICT, ENGINEERING STAFF. STORM RAINFALL OF EASTERN UNITED STATES. Miami Conserv. Dist. Tech. Rept. pt. 5, 310 pp., illus. 1917.

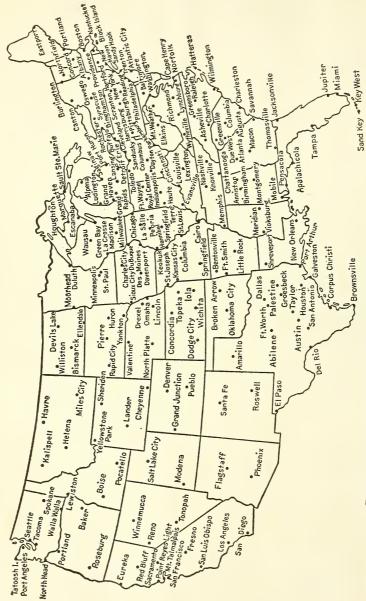


FIGURE 1.—Weather Bureau stations furnishing data for determining high short-time rates of rainfall.

5-year to 100-year frequencies. Other charts show the number of excessive rainstorms per 30 years that occur in each of the months. The data studied comprise all recorded by the stations indicated, through 1933. The short-period records cover a total of 28,077

rainstorms. (Snowfall was not considered in this study.)

Many recent researches have demonstrated that, as a basis for the design of improvement works, conclusions respecting the probable intensity and frequency of rainfall in a given area are far safer and more economical if drawn from a study of the occurrence at many stations than if drawn from 25- or 50-year records from only one station. Single-station records seldom, if ever, give a correct picture of the normal rainfall experience in any particular area. The charts presented herein are based upon the weighted rainfall experience of all Weather Bureau stations, and therefore are more dependable for design than the records of any individual station. However, since heavy rains are local phenomena and subject to local influences, especially in mountainous regions, the intensity-frequency charts shown are recognized to be, as predictions of future occurrence, probabilities rather than absolute certainties.

METHOD OF INVESTIGATION

Excessive storms may be divided into two classes, (1) rains of great intensity and short duration, and (2) rains of moderate intensity and long duration. Those of the first class, which are usually the more destructive, are the storms that are treated in this publication. In cities where nearly the entire watershed areas may be impervious, practically all of the storm water may find its way quickly into the sewers. On agricultural lands a large portion of the precipitation of quick, heavy storms may need to be carried off by the drains if flood damage is to be prevented, or by the terraces in order to avoid soil erosion.

To obtain accurate records of intensive precipitation for short periods requires automatic recording rain gages. The first automatic rain gage was used in 1888, by the Signal Service. (See report of the Chief of Weather Bureau for 1896–97, p. 362.) Since 1893 the Weather Bureau has installed many more self-registering gages, until by 1933 there were records made by such instruments at 211 stations (including a few stations at which records had been discontinued). The records of the intense precipitations at those stations have been published in the annual reports of the Chief of the Weather Bureau for 1895–96 and subsequently. Those records show—

the accumulated amounts of precipitation for each 5 minutes during all storms in which the rate of fall equaled or exceeded 0.25 inch in any 5-minute period, or 0.30 inch in any 10-minute period, or 0.35 inch in any 15-minute period, etc. If the period be 1 hour the minimum fall would need to be 0.80 inch; if 2 hours, 1.40 inches. (See report of the Chief of the Weather Bureau for 1929–30, p. 58.)

In the South Atlantic and the Gulf States, including Arkansas, Kentucky, and Tennessee, but not including the western portion of Texas, very heavy falls are so frequent that the published records show generally for those regions only the storms in which 1 inch or more fell in an hour.

The published Weather Bureau reports show the accumulated amounts of precipitation at 5-minute intervals during the storms.

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Figure 2.—Sample form of computation of maximum short-time rates of rainfall.

Comparison of the published data with the original records for a number of storms indicates that the actual maximum 5-minute precipitation during any storm commonly exceeds the published figure by 8 to 10 percent, when determined from the particular interval of greatest downfall rather than from the series of regular intervals. Similar comparisons for the 1-hour and 2-hour precipitations indicate that the actual 1-hour maximum is 4 to 5 percent greater than the published record, and the 2-hour maximum 9 to 12 percent greater, because the published records do not include rainfall at low rates near the beginning and the end of the storm. The method of arranging these data to determine maximum rates of rainfall for short periods is illustrated in figure 2. On this form are shown the storms of July 14, 1912, and September 2, 1922, at Washington, D. C. If a storm lasted only 40 or 50 minutes, for example, in preparing the charts the observed precipitation in that length of time was considered also as having fallen in periods of 1 hour and 2 hours. It should be noted that in parts of the United States, especially in mountainous areas of the West, intense storms of small extent such as local cloudbursts have occurred without being recorded by the Weather Bureau because the stations there

were not equipped with self-registering rain gages.

On such forms the times of beginning and ending of the storm and other data are entered on the line showing the observed precipitation by 5-minute intervals, up to 50 minutes from the beginning of the period of excessive precipitation, as copied from Weather Bureau records. Unusually prolonged precipitations of great intensity have been summarized to show accumulations at less-frequent intervals. The stated increments of precipitation were computed from the figures of observed precipitations on the line above. Each maximum precipitation shown for any storm is the maximum for the period of length stated by the figure in the heading of the column, and was determined by selection from the 5-minute increments. For example, in the 1912 storm (fig. 2) the maximum precipitation for 5 minutes is the fifth increment, that for 10 minutes combines the fifth and sixth increments, and that for 20 minutes combines the fifth, sixth, seventh, and fourth increments. In the 1922 storm the stated maximum for 5 minutes is half the eleventh increment, which is for 10 minutes, the 10-minute maximum is the eleventh increment, but the 15-minute maximum is the second, third, and fourth together. Comparison of the observed precipitations and the maximum short-period precipitations plotted in order is shown in figure 3.

Intensity-frequency diagrams were prepared for all stations (like figures 63, B and 64, B), from all records through 1933. From these were determined the maximum precipitations in periods of 5 minutes to 2 hours that have occurred with different average frequencies. In determining the 24-hour precipitations, all storms were considered that exceeded certain arbitrary limits set low enough to get reliable determinations for 5-year frequencies. For a few States, 33-year records were used; for some, 24½-year records; and for the others, the 20-year records covering 1914–33. The 4-hour, 8-hour, and 16-hour precipitations were obtained by graphic interpolation. The determined values for the 10-minute to 2-hour durations and for the 24-hour duration were plotted on logarithmic paper with the

coordinates intensity and duration, for each of a large number of stations, and smooth curves were drawn locating points of equal frequency. These curves showed the intensities of the precipitations

of 4, 8, and 16 hours duration.

On outline maps of the United States the amounts of precipitation in different periods for different recurrence frequencies, determined as just described, were marked in the proper locations. Then isohyetals—lines of equal precipitation—were drawn, the plotted values being weighted according to best judgment, considering the length and character of the records from the different stations.

PRECIPITATION RATES AND FREQUENCIES

A summary record of the most intense storm at each station, selected from consideration of the maximum short-time rate of precipitation, is given in table 1. The maximum short-period precipitations recorded at each station are given in table 2, which shows the records for periods up to 12 hours duration. The precipitation shown for any period, in table 2, may have occurred in a different

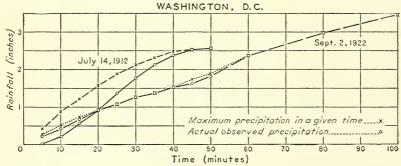


FIGURE 3.—Maximum short-period precipitations plotted in order of intensity compared with act ua storm record, for two heavy storms at Washington, D.C.

storm from that in which the precipitations shown for any or all

other periods occurred.

The maximum precipitations for periods of 5, 10, 15, and 30 minutes and 1 and 2 hours that may be expected to occur on an average of once in 2, 5, 10, 25, 50, and 100 years in continental United States are shown in figures 4 to 39, and the maximum precipitations for 4, 8, 16, and 24 hours expected to occur once in 5, 10, 25, 50, and 100 years are shown in figures 40 to 59. The isohyetal interval is not the same on all these charts; even on some individual charts there is variation.

For California, Oregon, and Washington the locations of the 5-minute to 2-hour isohyetals could be determined only approximately, because of the small number of rainfall stations having automatic recording gages. No attempt has been made to show the precipitations for 4-, 8-, and 16-hour durations in California and the western part of Oregon and Washington, and in this area the 24-hour precipitations are shown by figures for 28 districts instead of by isohyetals. (See figs. 60 to 62.)

Graphs of the high-intensity precipitations at Honolulu, T. H., and San Juan, P. R., and the corresponding curves of average frequency

are shown in figures 63 and 64.

The amount of surface run-off from a heavy rainfall, and the damage caused through floods or soil erosion in any locality, often depends in considerable measure upon the time of year when the storm occurs. The number of excessive short storms (2 hours or less duration) classed as excessive by the Weather Bureau that have occurred in each month, adjusted to a period of 30 years, are shown in figures 65 to 76, one figure for each month. The average period of record at the 206 stations is 29.5 years. The average number of storms in 30 years, as shown on the charts, was computed for each station as $n \times 30/y$, in which n is the number of excessive storms recorded and y is the length of the record in years. Comparison of figures 65 to 76 will show in what months heavy rainstorms are most frequent, for any part of the United States.

USE OF THE DATA

The rational method of estimating run-off is by substitution of known or assumed values for symbols in the formula

Q = CIA

in which Q = the rate of run-off, in cubic feet per second;

I=the rate of rainfall, in inches per hour;

C=the run-off coefficient, a decimal stating the portion of rainfall I that appears as run-off and depending upon the character of the drainage area;

and A=the drainage area in acres.

(The error of this formula is only 0.83 percent; exactly, with C=1.0000, a rainfall of 1.0000 inch per hour would give a run-off of

1.0083 cubic feet per second per acre.)

In applying this formula to any particular case, the area A is known, the rainfall rate I may be taken from the intensity-frequency charts (figs. 4 to 64) having regard for the economic aspect of the problem; and the coefficient C is a matter of judgment in comparing the case in question with others where run-off measurements have been made. Values of C for small agricultural lands have been given by Ramser 4 and values for impervious areas are stated in many textbooks on

design of sewers.

Examples will illustrate use of the graphs and tables herein. It may be required to estimate the rate of run-off from a watershed of 40 acres in the vicinity of Washington, D.C., in order to design a ditch to drain that area. The distance from the most remote point of the area to the outlet ditch, along the course of flow, will be 2,000 feet. The ground slopes and character of surface indicate a velocity of flow of about 180 feet per minute. The period of concentration of flow from all parts of the area is thus computed as $2000 \div 180 = 11$ minutes. The degree of protection deemed economical will permit overflow of the ditch not oftener than once in 5 years. By interpolation between figures 11 and 17 for Washington, D. C., the maximum precipitation in 11 minutes and of 5-year recurrence interval is about 0.86 inch or 4.7 inches per hour. Estimating the coefficient C as 0.40, and substituting in the formula stated, the run-off is calculated as $Q=0.40\times4.7\times40=75$ cubic feet per second.

⁴RAMSER, C. E. RUN-OFF FROM SMALL AGRICULTURAL AREAS. Jour. Agr. Research 34:797-823 Illus. 1927.

Suppose it is desired to estimate the size of ditch necessary to carry away the drainage from a swampy area of 4,000 acres situated in the vicinity of Vicksburg, Miss., for a storm to be expected once in 5 years. The distance of the most remote point might be 32,500 feet from the outlet, and the ground slope and cover be such as to give a velocity of 90 feet per minute for the flow between those points. The period of concentration for the area then would be 6 hours. By interpolation between figures 40 and 45, the maximum precipitation at Vicksburg in 6 hours, to be expected with 5-year frequency, is 4.2 inches or 0.7 inch per hour. Assuming 0.4 for the coefficient C, the run-off then is computed as $Q=0.4\times0.7\times4,000=1,120$ cubic feet per second.

Table 1.—Most intense rainstorm recorded at each station through 1933

0																				
35		En	Entire storm		E	Fall				Precil	oitatic	Precipitation for various periods, in inches	vario	ns per	iods,	in in	ches			
Station and date	Item	Dur	Duration	Rain-	cessive rate	to ex-					M	Minutes	S						Hours	rs
		From-	T0-	fall	редап	sive rate 1	5	10 15	20	25	30 35	2 40	45	20	8 09	80 100	12	8	9	12
Abilene, Tex	Observed precipitation-	4:10 p.m.	5:15 p.m.	In. 2. 43	4:19 p.m.	In. 0.01	0. 40 1. 06	1	48 1. 77	2.032	24 2.	37 2. 41			1					
Sept. 5, 1920.	Maximum for period	1:42 p.m.	3:02 p.m.	1.85	1:54 p.m.	.02	98.2	31.4	1.481.77	.~.	242	3 2. 24 2. 37 2. 41 0 1. 58 1. 60 1. 66 1. 67 1	5 1.67	.67	85					
Aug. 11, 1914. Albena, Mich	Increment Maximum for period Observed precipitation	3:20 p.m.	5:45 p.m.	1.18	3:20 p.m.	0.	3%4	3443	91.35	.5.3	581.	601.6	61.67	26	1.82		111			111
May 29, 1914. Amarillo, Tex	Maximum for period Observed precipitation.	9:45 a.m.	7:15 p.m.	3.86	1:28 p.m.		1888	24 1.04 24 1.04 35 49	97	1.37	681.8	301.8				111	111			1111
May 26, 1905. Anniston, Ala	Maximum for period— [Observed precipitation_ Topesment	3:45 p.m.	11:45 p.m.	4.35	3:45 p.m.	0.	3488	88 1.19 86 1.45 57	*i ^i	1.591 2.652	2.973.	3, 25 3, 4;	3, 43, 3, 50, 3, 60	3,60						1 1 1
Sept. 5, 1906. Apalachicola, Fla	Maximum for period	7:40 a.m.	6:30 p.m.	3.691	69 11:18 a.m.	. 28	.0651	15 18	.01	36 2. 68 2 26 . 34 26	97 3.	<u>.</u>	33.50	232	128					1 1 1
May 2, 1923. Asheville, N.C.	Maximum for period—— Observed precipitation—	2:10 p.m.	7:10 p.m.	2.27	2:16 p.m.	.01	8884	261.5 311.7 83	2.1.0 1.8.0 1.8.0 1.80	2.04	2, 23 2.	37 2. 45	2.49		12.					1 1 1 1
Atlanta, Ga	Maximum for period Observed precipitation. Increment.	10:50 a.m.	11:42 a.m.	2.931	10:53 a.m.	.01	83 1. 30	311.7 951.4 65.4	1, 71 1, 80 1, 44 1, 90 2, 10 49 46 20	2.102	34 2.	35 . 12	1 2.91 2 . 10			+++				1 1 1
Atlantic City, N.J.	Maximum for period Observed precipitation. Increment	5:45 p.m.	11:55 p.m.	5.40	5:47 p.m.	T	. 65 1. . 14 . 14	1. 14 1. 60 35 . 49 . 21 . 14	$\frac{01.90}{4.11}$	1. 90 2. 10 2. 34 2. 60 . 73 . 83 . 111 . 13 . 10	2.34 2.	69 2, 81 2, 92 1, 14 1, 09 , 22 .	1 2.91 4 1.36 2 . 22	1.50	22	89 3.	83 4. 0	4.7	72	111
Augusta, Ga	Maximum for period Observed precipitation.	5:35 p.m.	8:30 p.m.	2.91	5:42 p.m.	.02	561.	. 67 . 95 . 80 2. 11 24 . 31	51.17 12.26 15.15	1.50 2.46 20 20	-i 2i '	89 2. 08 2. 77 2. 88	3	2. 33	2. 69 3.	23 3	83 4. 0	7 4. 7	2	111
June 18, 1911. Austin, Tex. May 6, 1930.	Maximum for period Observed precipitation Increment	5:15 a.m.	10:45 a.m.	1.941	1.94 10:01 a.m.	. 23	1.24	80 2.11 38 .88 27 .50	12.26 81.36 1.48	2.462 1.571	69 17 5 17 17 17 17 17 17 17 17 17 17 17 17 17 1	2.1.	00 = = =							
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Table 1.—Most intense rainsform recorded at each station through 1933—Continued

		Fint	Entire storm	_		:				Proc	nitati	on for	Toric	Precinitation for various periods in inches	riode	in	ohoc				
		all a	TIE SCOLUT		Time ex-	Fall				nair	bicar	101 10	V du III	od en	enorie		SITOT	-	-		
Station and date	Item	Duration		Rain-	cessive	to ex-					FI	Minutes	SS						H	Hours	
		From-	То—	fall	оевап	rate 1	2	10 15	5 20	25	30	35 40	0 45	20	09	08	100 120	20	3	9	12
Baker, Oreg	Observed precipitation.	2:40 p.m.	4:20 p.m.	In. 0.95	3:05 p.m.	In. 0.06_0.08_0.20_0.36_0.50_0.66_0.78 0.8_12_16_14_16_12_	0.080	20 0.	36.0.5	0.66	0.78										
July 13, 1908. Baltimore, Md	Maximum for period. Observed precipitation. 12:01 p.m. Increment.	12:01 p.m.	1:10 p.m.	2.8715	87 12:04 p.m.	0.	333	65 65 65 65 65 65 65 65 65 65 65 65 65 6	46 72 2. 2 74 . 5	22.52	70 . 78 52 2. 69 2. 87 29 . 17 . 18	18									
Bentonville, Ark	Maximum for period Observed precipitation.	8:45 a.m.	4:55 p.m.	2.38	1:11 p.m.	. 21	4.88	. 39 1.4 0.6 1.0	. 902. 2 . 401. 0	3.2. 52 4.1. 59 4.55	52 2. 69 2. 87 59 1. 76 1. 81 55 17 05		1.88					++	++		
Apr. 23, 1908. Binghamton, N.Y	Maximum for period— [Observed precipitation— [Description]	8:40 p.m.	(6)	2.36	8:46 p.m.	.02	199	34 18	451.6 58.6 .6	17.	68 1, 76 1, 81 77 1, 03 1, 39		22.1	72.102.182.2	107.4	2.24					
June 24, 1924. Birmingham, Ala	Maximum for period Observed precipitation.	1:54 p.m.	6:06 p.m.	2, 19	2:15 p.m.	.01	864	04 04 1.	53 1.8 53 1.8 58 1.8	31.46		:-: <u> </u>	942.1	94 2, 10 2, 18 2, 22 2.	2, 22						
Sept. 3 1918. Bismarck, N.Dak	Maximum for period Observed precipitation.	8:15 p.m.	(3)	3.6010	60 10:53 p.m.	.04	41.41	131.	921.8 45.1.2	31.97	1.89	402.	73 2. 9	1.89 2. 40 2. 73 2. 94 2. 99							
Aug. 9-10, 1909. Block Island, R.I	Maximum for period [Observed precipitation.]	1:45 a.m.	8:40 a.m.	3.32	5:32 a.m.	.36	382	2021	261.5 36.4 16.4	1.93	.2. 2.26 2.26 2.26	592	2.802.9	94 2. 99 57 . 64 03 . 04	.74	1.302	1.302.362.	31			
Sept. 3, 1928. Boise, Idabo	Maximum for period————————————————————————————————————	8:52 p.m.	1:20 a.m.	1.27	9:31 p.m.	.01	88.88	2 4 8	871.0 17.2	2888	4.4.8	521.	1. 59 1. 71 58 . 60 07	_		2.062		67			
July 30-31, 1912. Boston, Mass.	Maximum for period	1:38 p.m.	4:45 p.m.	1.73	1:48 p.m.	T	04	8:12	1233	71.13	1.301	252 22 22 23	69 7 1.541 6 02 0	828	.95						
Aug. 7, 1908. Broken Arrow, Okla	Maximum for period Observed precipitation Increment	10:30 p.m.	1:20 p.m.	6.99	2:59 a.m.	2.65	888	34.0	07 1. 2 50 . 6 16 . 1	3.19	96		54 1. 6 17 1. 3 09 . 2	81.66	2.18	18 2, 86 3. 1 52 , 68 , 2	107	111			
Brownsville, Tex.	[Maximum for period Observed precipitation Increment	3:00 a.m.	7:05 a.m.	5.92	3:43 a.m.	90.	888	2525	80 1. 0 92 1. 1 36 . 2	31.18	.32	. 29 2. 48	. 691.7 . 673.0 . 38	81.902. 63.474. 9.411.	2.4.1.	2. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	0 9 8		5.86		
Buffalo, N.Y.	Maximum for period Observed precipitation. Increment.	11:45 p.m.	4:00 a.m.	2.51	2:44 a.m.	.19	49	3.45 2.75 1.75 1.75 1.75 1.75 1.75 1.75 1.75 1	81 95 39 14	32.46 51.11 1.16	2. 943 1. 261	39 E	3.573.8 1.681.7 .29	34, 194, 91, 902, 1, 11	. 25 . 22 . 32 . 32	5. 63.5	. 76 5.	81	5.8635	5.92	
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Table 1.—Most inlense rainstorm recorded at each station through 1933—Continued

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Eastport, Maine	Aug	Elkins, W.Va Aug. 4, 1911	Ellendale, N.Dak	July	El Paso, Tex.	Jun	Erie, Pa	Ma	Escanaba, Mich	July	Eureka, Calif.	Nor	Froncaille Ind	Aug	,	Flagstaff, Ariz.	Aug	ort. 8	July 23, 1908.		Fort Wayne, Ind.	, m	Fort Worth, Tex.	Aug	Fresno, Calif.	Oct	alve	Oct. 5-6, 1910.	ranc	Aug. 9, 1906.	Grand Junction, Colo	Aug	Grand Rapids, Mich.	Jun	
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Table 1.—Most intense rainstorm recorded at each station through 1933—Continued

		En	Entire storm			Foll				Pre	eipit	Precipitation for various periods, in inches	for v	vario	us pe	riod	in,	inche	20			1
Station and date	Item	Dur	Duration	Rain-	Time ex- cessive rate	prior to ex- ces-			1			Mir	Minutes							-	Hours	
		From-	То—	fall	редап	rate 1	5	10 1	15 2	20 25	30	35	40	45	50	09	08	100 120	120	ಣ	9	12
Green Bay, Wis	Observed precipitation 10:45 a.m.	10:45 a.m.	11:45 a.m.	Im. 2, 111	2. 11 10:45 a.m.	<i>In.</i> 0	.83	0. 23 0. 60 0. 92 1. 29 1. 59 1. 81 2. 03 2. 08 2. 03 3. 37 3. 37 37 30 37 32 32 32 32	0.921.	0.92 1.29 1.59 1.81	800 801.8	2.25	2. 03 2. 08	20.10								
Greensboro, N.C.	Maximum for period Observed precipitation. Increment	6:35 p.m.	7:30 p.m.	96	. 96. 6:45 p.m.	.01	28.83		980	938	34 . 95 34 . 95 31 . 01	25.0	37.02	~								
Greenville, S.C.	Maximum for period Observe precipitation.	1:50 p.m	4:00 p.m.	2.06	1:59 p.m.	.01	2.22.2	1.311.	1. 68 37 83	223	. 94 . 95											
Aug. 6, 1931. Grocsbeck, Tex	Maximum for period Observed precipitation.	6:20 p.m.	7:10 a.m.	8,551	11:38 p.m.	2.37	101	1.311.	1.68	1. 68 1. 87 1. 98 30 . 34 . 49	1. 98 - 49 - 65 15	5 . 77	95	1.16	. 95 1. 16 1. 22 1. 63 2. 50 3. 50 4. 18 2. 1 06 4. 4. 1 87 1. 00 1.	1.63	2.50	3.50	8 %			
Oct. 1-2, 1927. Hannibal, Mo	Maximum for period [Observed precipitation.]	9:00 p.m.	6:50 a.m.	2.43	1:57 a.m.	.04	33.53	. 921. 221. 481. 741. 96 2. 18 . 801. 331. 631. 811. 90	1.221.	631.8	14.18 1.196 1.196	6 2. 18	32.48	32.75	2. 48 2. 75 2. 99 3. 35 4. 03 4. 64 5. 02	3, 35	4.03	4.64	0.02			
Aug. 17–18, 1906. Harrisburg, Pa	Maximum for period— Observed precipitation— Ingrement	6:00 p.m.	(2)	2.87	7:35 p.m.	. 43	52.41.	188	1.33 1.45 1.45	1. 33 1. 63 1. 81 .64 .65 .79	791.90	1. 33 1. 63 1. 81 1. 90 64 . 65 . 79 1. 05 2. 09 2. 21 10 01 14 261 04 12	2.21	2.31								
Aug. 8, 1925. Hartford, Conn	Maximum for period— Observed precipitation— Increment	3:30 p.m.	4:35 p.m.	2.93	3:40 p.m.	.03	1.08	1.301.441.561.641.952.09[2.212.31 33.45.721.111.341.67[2.322.77 95.19.97.30.23.33.65.45	45 4	721.	24.1.9	4 1. 67	2.32	22.77	7 2.89							
Aug. 1, 1929. Hatteras, N.C	Maximum for period— Observed precipitation— Increment	9:55 a.m.	7:15 p.m.	7.90	7. 90 10:22 a.m.	. 14	888	30.12	1. 43 65 1.	1. 662. (1. 191. 7 54	2.052.3	1. 43 1. 66 2. 65 2. 32 2. 44 2. 69 2. 81 2. 89 65 1. 191. 75 2. 22 2. 65 3. 06 3. 54 4. 05 5. 26 3. 57 54 51 1. 21	2.8	2.8.	2.89 4.05	5.26	5.52					
Sept. 5, 1928. Havre, Mont.	Maximum for period Observed precipitation	8:31 p.m.	9:20 p.m.	.8	8:56 p.m.	.00	500	1. 21 40 30	772 2.		313.0	3. 04 3. 51 4. 07 4. 61 4. 96 5. 26 5. 52	4.07	4.61	4.96	5.26	5.52					
July 9, 1809. Helena, Mont	Maximum for period— Observed precipitation— Increment	4:06 p.m.	7:45 p.m.	.94	4:50 p.m.	.08	088	1087	77.	76 .81	25.2								111	111		
Honolulu, Hawaii	Maximum for period Observed precipitation.	4:15 p.m.	8:15 p.m.	2.94	5:21 p.m.	.34	74.	30	8 6 6	. 79 1. 22 . 36 . 43	22 1.52 1.	79 1, 22 1, 52 1, 76 2, 01 36 , 43 , 30 , 24 , 25	2.01	2.22	2. 22 2. 38 2. 45 . 21 . 16 . 07	2.45						
Dec. 30, 1923. Houghton, Mich	Maximum for period Observed precipitation. Increment	10:58 p.m.	12:58 a.m.	1.81	1.81 11:00 p.m.	10.	85.55	79 1. 09 1. 33 1. 58 1. 79 1. 95 2. 08 2. 3	09 20 1.	331.	351.7 351.4 21.0	1, 09[1, 33]1, 58[1, 79]1, 95[2, 08]2, 25[2, 38]2, 45[] 99[1, 14]1, 35[1, 44]1, 48[1, 50]1, 52[1, 55]1, 62[1, 70]1, 78[1, 8] 2.20[15, .21]09[04]02[02]07[08]08[08]	31.50 31.50	1.52	2.38	2.45 1.62 .07	1.70	1.78	1.81	111		441
Houston, Tex	Maximum for period Observed precipitation- Increment	1:15 p.m.	2:20 p.m.	2.72	1:15 p.m.	0	84.00	79 15 06	99 10 10 10 10 10 10 10 10 10 10 10 10 10	14 1, 35 1, 44 22 , 48 1, 07 03 , 26 , 59	35 1. 4 18 1. 6 36 . 5	. 99 1. 14 1. 35 1. 44 1. 48 1. 50 . 19 . 22 . 48 1. 07 1. 91 2. 48 . 04 . 03 . 26 . 59 . 84 . 57	1, 48 1, 50 1, 52 1, 55 1, 91 2, 48 2, 62 2, 66 , 84 , 57 , 14 , 04	2.62 32.62		1.62	1. 70	1.78	20			
Aug. 11, 1920.	[Maximum for period						.841	1, 43 2.	00 2.	2612.	10 2.4	42.4	7 2. 55	312, 62	53/2, 62/2, 66		1					1

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			1.414	4	42	2.74	5.963	6.257	112	455.	45						
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2.56	2.56		3. 403. 66	3.66	32.	2.37	1.85	4. C.	1.57	1.522	1.1 2.25 2.25	1.94		3.02	33.0	3.06	,;
2.41	2.41	2.80	2 6 8 8 6 8	3.40	4.01	. 4. 2. 26 7.	. 2. 1. 2. 26 3. 48 8. 88	2.24	1.55	1.55 1.41	1. 41 1. 65	1.87		2.91	2.96	2.99	2½ hours
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i i	a.m.	6:10 p.m.	8:00 a.m.	p.m.	a.m.	a.m.	7:50 p.m.	6:25 p.m.	p.m.	p.m.	2:30 p.m.	a.m.	i i	p.m.	p.m.		
9:10 p.m. 3:32 p.m.	11:35 a.m	6:10	8:00	9:30 p.m	7:25	7:25	7:50	6:25	12:05 p.m	10:03 p.m	2:30	6:50 a.m.	5:55 p.m.	9:10 p.m	6:37		
		вi	в	B	a.m.	ij	E	ä	a.m.	p.m.	i	B	g	В	H.	Ħ	
6:25 p.m. 0:45 a.m.	7:45 a.m.	4:03 p.m.	9:30 p.m.	5:40 p.m.	4:10 a	5:55 p.m.	3:02 p.m.	4:45 p.m.	9:37 a.	8:03 p.	9:00 a.m.	8:30 p.m.	4:30 p.m.	5:39 p.m.	5:20 p.m		
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Huron, S.Dak June 14, 1924. Indianapolis, Ind.	Iola, Kans Oct. 1, 1923.	Jacksonville, Fla- July 27, 1917.	ter, I	Kalispell, Mont Aug. 10, 1920	Kansas City, Mo	Keokuk, Iowa	Key West, Fla-	Knoxville, Tenn.	LaCrosse, Wis	June 11, 1929. Lander, Wyo	Lansing, Mich.	LaSalle, Ill	Lewiston, Idaho Aug. 24, 1907.	Lexington, Ky	Lincoln, Nebr	July 25, 1914.	
Hur Ju India	Iola, Oc	Jack	Jupiter, Fla	Kalis Au	Kan	Keol	Key	Kno:	LaCi	Land	Lans	LaSa	Lewi	Lexi	Line	3	

Table 1.—Most intense rainstorm recorded at each station through 1933—Continued

		Ent	Entire storm			Fall				Precip	Precipitation for various periods, in inches	n for	vario	is per	ods, i	n incl	sət		
Station and date	Item	Duration		Rain-	cessive rate	to ex-					M	Minutes							Hours
		From-	То—	tall	редап	sive rate 1	5 1	10 15	20	25	30 35	2 40	45	50	08 09	100	120	ಣ	9
Little Rock, Ark	Observed precipitation.	12:40 p.m.	6:40 p.m.	In. 2.94	3:56 p.m.	<i>In.</i> 0.31 0.15 0.33 0.56 0.91 1.12 1.15 1.18 1.23 1.35 1.21	15 0.	33 0. 54	60.91	1.121	1. 52 1. 8	85 1. 97 2. 04: 33 . 12 . 07	2.04	25.29	26			1 1	
Los Angeles, Calif	Maximum for period Observed precipitation.	11:30 a.m.	7:45 p.m.	3.10	12:27 p.m.	. 18	9.0.6	73 .96 1	96 1. 29 1. 52 21 . 29 . 32 10 08	1.521		35 1. 9. 11 . 48	2,14	2. 29 . 63 	36 1.	73 1.90			
Feb. 18, 1914.	Maximum for period	5:52 p.m.	9:35 p.m.	4.60	6:08 p.m.	.15	828		202		1. 10 1. 18 1. 28 1. 32 1. 38 1. 70 1. 90 2. 06 2. 22 2. 38	02.00	1. 32	1.381.	1. 44 1. 73 1. 90 2. 70 3. 43 4. 15 4. 35	31.96	4.35		
July 4, 1896.	Increment Maximum for period			1 11			.551.	1.051.3	7 1.55		1.91 2.07 2.2	20 . 16 07 2. 23	. 16 . 16 . 16 . 23 2. 39 2. 55	2.55	16 . 32 . 73 55 2. 92 3. 64	32 . 73 . 72 . 20 92 3, 64 4, 15 4, 35	20.20		
Ludington, MichJune 26, 1931.	Upserved precipitation.	5:38 a.m.	8:28 a.m.	1.87	5:43 a.m.	10.	882	52 30		14 08	. 06 . 04 . 02 . 04	74.1.4 0.1.4	\$ 45	1.48	1. 55 1. 75 1. 82 1. 86 . 07 . 20 . 07 . 04	20.07	20.8		1 1
Lynchburg, Va	Observed precipitation.	8:30 p.m.	1:20 p.m.	2.78	9:10 p.m.	.04	. 55 1.	55 1. 06 1. 51 1. 89 2. 03	11.89		2, 13	1.4	T. 48	1, 40 I	.00 T	1. 70 1. 82 1.	1.80		
Aug. 29-30, 1903.							. 55 1.	55 1. 06 1. 51	1.89	1.892.032	13			11					1 1
Macon, Ga	Observed precipitation.	12:42 p.m.	3:20 p.m.	3, 35	3. 35 12:42 p.m.	0	.21	.35 .47	.60	.741	1. 18 1. 8	30 2.3	2.70	20 2. 88 3.	3, 11 3, 5				
July 18, 1916.	Maximum for period	5.00 n m	8.45 n m	4 96	5.94 n m	10	621.	20.5		-	. Ci c	. 0! c	53 2, 70 2, 88	2.883	113.5	32			
Madison, WisAug. 8, 1906.	Increment Maximum for period	- Constant		2	orex pum.		22.2	1 62 3	88.5		27.27	202	21.0	34.	42.6	93 . 30			
Marquette, Mich	Observed precipitation.	4:25 p.m.	8:15 p.m.	3.95	4:32 p.m.	L	368	533	75	1.021	i -i_	70 1.9	91 2, 17	2.45	ಕಣ್ಣಿ	54 1.0			
June 23, 1907.	Maximum for period			1 10			32:	189	1. 16		671	93 2, 18 2.	2.34	2.50	933	54	1 13		
Memphis, Tenn	Operved precipitation, 11:00 p.m.	11:00 p.m.	z:00 a.m.	00.0	5. 00 11:34 p.m.	. 05	141	08.22	39.	$\frac{1.42}{60}$	57	44 . 46 . 24	22.5	2.2	25. 01.53.	87.4.554.69 $62.68.14$	3.14		
Meridian, Miss	Maximum for period	1:40 a.m.	6:25 p.m.	3.92	1:42 p.m.	.01	. 17	38 . 7	61 2. 07 2. 46 76 1. 25 1. 81		2. 28 2.	912.95	က္တတ္	40	633.7	4.5	4. 55 4. 69		
Aug. 13, 1906.	Maximum for period						561.	0511.5	21.90	2, 152	362	25 . 20 56 2, 73	73 2, 96	- LC	3.633.7	- 4			
Miami, Fla	Observed precipitation.	3:12 p.m.	5:48 p.m.	5, 17	3:20 p.m.	.02	43.	87 1.5	7 1. 79	2,342	893	24 3, 53	53 3, 79	9.00	50	09 5, 12	25.13		
Miles City, Mont	Maximum for period	11:30 p.m.	2:15 a.m.	1.02	1.02 11:37 p.m.	.02	70 1. 14	14 1.5	2.02	22.462	893	24 3. 5.	3.79	4.004	4, 53 5. (09 5. 12 5. 13	5. 13		
July 21–22, 1923. Milwankee. Wis	Maximum for period Observed precipitation.	1:02 p.m.	3:25 p.m.	2.53	1:05 p.m.	T	38.	62 8 14 8 12 8 12 8 13 8 14 8 15 8 16 8 17 8 18 8 18 8 18 8 18 8 18 8 18 8 18		1.23	641.	92.00	2.11	2.20					
June 24, 1904.	Increment.				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		. 08	90	5 . 42	. 52	41	5	Ξ	60					

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Ħ	II		3.03	1.40	9.4		4.5	1.80	8	88	2.98			4.8		2.52	
T			2.85	1.40	1.40		15.8	.1.1 84.25	1.67	.95	2.802.			.65	. 69 1. 76 2.	2.33	
			2.48	.2.1 888	1.38	H	.67	1.68 1.67	1.67	.94	2. 69 2. 46 2. 46	2.46 1.80	1.80 1.91	 1.91 .60	60 60 60	2, 19	
			1.98	1.35	1.35		86.5	34 1. 41 67 1. 67	1.67	86	2.58 2.41	2. 41 1. 76	1.35	1.89 1.57	1.30	.1.98 1885	. 2. ±
1.35	1.35		1.44	2.49	1.34		.54	1.34	1.67	.87	2.36	2.31 1.72	1.80	1.80	1.05	1.69 2.13	1. 43 1. 74 1. 94 2. 13 3 ² During the night
1.31	1.59	1.59	1.08	2.15 1.33	1.33	. 49	1.53	1.12	1.65 2.32 8.32	2.32	2. 14 2. 14	2. 14 1. 66	1.66	1.74	34.56	1.39	1: 94 1: 94
1. 14	1.56	11.	1.06	1.78	1.28	. 45	.34		1.49 2.26	2.26	1.75	1.93	1.57	1.77	4.28	1.19	1.74
. 52	1.18	1.48	86.66	11.	1.22.6	1.14	122		1.33	1.75	7483	.11	1.35	25.1	26.45	1.83	1. 43 D
1.08	1338	1.33	8877	11	.1.08 821.9	8,000	28.5	1.19	1.19	1.23	1002	1884	28.4	245	11.28	888	55
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p.m.	p.m.	p.m.	B	B	B	ä	В	Вi	B	ij	Шġ	ij	Вİ	įį	a.m.	p.m.	
9:04 p.	5:52 p.	3:38 p.	10:38 a.m	8:04 a.m	12:30 a.m	2:10 p.m	10:50 a.m	9:26 a.m	06 a	28 p	3:48 p.m	2:10 p.m	1:09 p.m	3:49 p.m.	2:30 a	6:04 p.	
6 09	62 5	90	65	1 18	61 12	62 2	98	1 12	40 12:06 a.m	01 10:28 p.m	23	96	92 1	1 188	82	23 6	
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11:30 p.m.	6:56]	4:02	3:35]	9:40 a.m	2:35]	5:35	5:05 p.m	2:55 p.m	(2)	(E)	5:45 p.m	5:15 p.m	2:05	(2)	5:10 a.m	8:12	
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7:30 p.m.	5:10 p.m	34 p.m	5 a.m	94 a.m.	©	:25 p.m.	20 a.m.	24 a.m	11:45 p.m	30 a.m	55 p.m	40 p.m.	1:08 p.m	12 a.m	1:45 a.m)2 p.m	trace
		6	10:05	8:04			8:20	9:24	<u>' ' </u>	8:30	1 133	1 121	! ! .	6:42	! !	6:02	
served precipitation.	Maximum for period Observed precipitation.	Maximum for period Observed precipitation	Maximum for period Observed precipitation.	Maximum for period Observed precipitation.	Increment Maximum for period Observed precipitation Increment	Maximum for period Observed precipitation	Maximum for period Observed precipitation	Maximum for period Observed precipitation	ximum for period	Maximum for period Observed precipitation	Maximum for period Observed precipitation	Maximum for period	Maximum for period Observed precipitation	Maximum for period Observed precipitation	Maximum for period Observed precipitation	Maximum for period Observed precipitation	od
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Minneapolis, MinnJune 26. 1914.	B	July 19, 1917. Modena, Utah.	July 27, 1916. Montgomery, Ala.	1905. Mir	Aug. 29, 1908. Mount Tamalpais, Calif.	Mount Weather, Va.	Nantucket, Mass.	Nashville, Tenn.	New Haven, Conn.	July 24, 1928. New Orleans, La	Apr. 15-16, 1927. New York City, N.Y.	Aug. 12, 1926. Norfolk, Va	Aug. 31, 1901. Northfield, Vt.	Aug. 14, 1918. Northhead, Wash	Dec. 10, 1920. North Platte, Nebr	Aug. 25, 1929. Oklahoma City, Okla	1923
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Table 1.—Most intense rainstorm recorded at each station through 1933—Continued

TARON Electron Transport In February as concerns are order to Contrations	Pall Precipitation for various periods, in inches Precipitation for various periods, in inches Precipitation for various periods cessive	[all Degail Sive and Tate 1	1. 71 1. 91 2. 05 2. 21 2. 33 2. 53 2. 60 2. 20 . 14 . 16 . 12 . 20	47 1. 63 1. 71 1. 91 2. 05 2. 21 2. 33	.81 1.17 1.63 2.14 2.71 2.89 3.07	20 30 90 2, 16 37 1, 75		05 07 14 07 59 88 373 653 803 944 014 154	2, 60	2. 32 2. 45 2. 52 2. 57 2. 14 2. 52 2. 75 2. 95	. 08 . 20 . 32 . 30 . 34 . 60 . 38 . 23 . 20 . 63 1. 11 . 53 . 60 . 941, 28 1, 621, 922, 242, 472, 672, 993, 303, 794, 8215, 25	. 32 . 21 . 12 . 04	1.75 7:12 p.m	1.38 1.44 1.35 1.41	26 . 37 . 69 . 85	. 59 . 68 . 80 . 47 . 51	.32 4.06 p.m. T .27 .30 .47 .51	
200000000000000000000000000000000000000			5 10 15	0.97	. 67 . 97 I. 74 1. 21 I.	74 1. 21 1. 28 . 09 . 26 . 55		.15 .08 .67 .671.141.52 .05 12 26	801 53 9 29 2 8	T 13 50 731.0	. 51 .871.201.8		18 18 18 18 18 18	.32 .60 .81	264.	2888	. 32 . 12 . 36 . 24 . 36	24 36 47
		cessive rate		4:49 p.m.	5:17 p.m.	4:20 p.m.	1 1	6.49 m m		0 4:12 p.m.	11	- ! !	9:11 p.m.	7:12 p.m.	2:59 a.m.		8:11 a.m.	4:06 p.m.
Tuesday I	storm		To— fall	6:24 p.m. 2.98	9:40 p.m. 1.48	7:00 p.m. 3.5	4:45 p.m. 2.2	++	÷	5:17 p.m. 2. 60	1.20 m.m. 5.48		2:25 a.m. 1.4	7:55 p.m. 1.7	3:45 a.m. 1, 40	1:55 p.m. 1.08	9:20 a.m.	4:35 p.m33
non electron	Entire storm	Duration	From-	1:02 p.m. 6:2	4:47 p.m. 9:	3:35 p.m. 7:0	3:00 p.m. 4:4	11:45 a m	and drive	4:11 p.m. 5:	10:50 a.m. 1:5		8:34 p.m. 2:	6:08 p.m.	2:55 a.m. 3:	12:34 p.m. 1:3	6:10 a.m. 9:5	4:00 p.m. 4:
TABLE I.		Item		Observed precipitation.	Maximum for period Observed precipitation	Maximum for period	Maximum for period Observed precipitation.		Increment.	Observed precipitation.	for period	1 1 1	Observed precipitation.	Maximum for period	Maximum for period	Maximum for period	Maximum for period Observed precipitation.	Maximum for periodObserved precipitation_
		Station and date		Omaha, Nebr		July 3, 1915.	May 9, 1921.	Aug. 19, 1903.	Pensacola, Fla	Peoria, III	July 2, 1931	Philadelphia, Pa	Phoenix, Ariz	July 17-18, 1908.	Aug. 29, 1912.	June 26, 1931. Pocatello, Idaho	Aug. 9, 1930. Point Reyes Light, Calif	Nov. 3, 1918. Port Angeles, Wash.

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Table 1.—Most intense rainsform recorded at each station through 1933—Continued

		Ent	Entire storm			Fall				Pr	ecipit	Precipitation for various periods, in inches	for v	arion	s per	iods,	di ni	ches				
Station and date	Item	Duration		Rain-	Time ex- cessive rate	prior to ex- ces-						Min	Minutes						-	H	Hours	
		From-	То-	fall	реван	rate 1	20	10	15 2	20 25	2 30	35	40	45	20	09	80	100 120		6	9	12
Saginaw, Mich.	Observed precipitation-	2:25 p.m.	5:12 p.m.	<i>In.</i> 1.30	4:41 p.m.	<i>In.</i> 0. 08 0, 18 0, 49 1, 11 0. 18 0, 18 0, 31	. 18	. 491	11.	22												1.1
Saint Joseph, Mo	Maximum for period Observed precipitation. Increment	9:27 a.m.	4:10 p.m.	3.62	2:28 p.m.	2.19		. 931, 111, 22 . 451, 011, 251 . 38 . 56 . 24	1.011	252	34 1.39	1000						111	111	111	111	3
Saint Louis, Mo	(Maximum for period Observed precipitation. Increment	12:20 a m.	3:00 a.m.	3.17	1:14 a.m.	. 10	966	. 94 1. 18 . 26 . 41 . 17 . 15	41.	27 56 15	271.341.39 $56.821.11$ $15.26.29$	1 1.24	1.34	1.79	. 79 2.34 2.82 2.95	822	13	111	111			
St. Paul, Minn	Maximum for period Observed precipitation.	7:02 p.m.	10:45 p.m.	3, 15	7:38 p.m.	. 23	100	85.8	1. 24 23	1. 48 1. 74 1.	. 55 1, 00 1, 24 1, 48 1, 58 1, 71 .10 . 19 . 42 . 74 1, 09 1, 55 .10 . 09 . 23 . 32 . 35 . 44	1, 48 1, 58 1, 71 2, 00 74 1, 09 1, 55 2, 07 32 , 35 , 44 , 54	2.26	CA CA	2.562 2.372 .05	2008 2308 2308 2308	92		111			
June 14, 1924. Salt Lake City, Utah	Maximum for period Observed precipitation Increment	7:40 p.m.	9:30 p.m.	98.	7:49 p.m.	T	3008	98 36 36	331	80 03 03	. 98 1. 33 1. 65 1. 89 2. 12 . 66 . 77 . 80 . 83 . 85 . 36 . 11 . 03 . 03 . 02	2. 12 2. 21 . 85 . 86 . 02 . 01	2.31	6	32 2. 41 2. 60	09						
San Antonio, Tex	Maximum for period Observed precipitation. Increment	12:50 p.m.	4:17 p.m.	5, 59	1:39 p.m.	. 13	07.0	34	25617	. 101.	.83 1.43 1.8 .33	. 56 1. 10 1. 43 1. 81 2. 01 2. 44 2. 22 . 54 . 33 . 38 . 20 . 43	2.44	2. 44 2. 56 2. 68 2. 83 3. 11 3. 29 4. 01 43 12 12 15 28 18 72	. 12	833.	282	3.29 4.01 . 18	4.01	111		
Apr. 18, 1915. San Diego, Calif	Maximum for period Observed precipitation	7:26 p.m.	9:00 p.m.	. 95	7:34 p.m.	.02	288	. 25	1.36 1.52 1 .42 .55 17 .13	52 55 13	1.88 83 83 1.83 1.83	10 2. 37 93 10	2. 49	2.61	2. 682	83.33	133	29 4.	19			
Mar. 15, 1905. Sand Key, Fla	Maximum for period — Observed precipitation—	2:00 a.m.	4:25 a.m.	2.98	3:30 a.m.	. 24	888	14. 15. 14. 17. 18. 19. 19. 19. 19. 19. 19. 19. 19. 19. 19	94 37 11	24 20 20 20 20 20 20 20 20 20 20 20 20 20	. 85 . 93 1. 81 2. 13 37 . 32	75 85 93 144 1.812 132.35 2.62.74 50 37 32 22 22 27 12	2.62	2.74								
Sandusky, Ohio	Maximum for period Observed precipitation. Increment	8:30 p.m.	11:45 p.m.	2.101	10:12 p.m.	. 13	888	32 1	1.351. 24	89 1. 33 .	30 1. 6 41 . 3	. 722. 04 2. 26 2. 53 2 . 89 1. 30 1. 63 1. 88	3 2. 65 2.	2.74				111	111	111		111
Sandy Hook, N.J.	Maximum for period Observed precipitation. 6:50 p.m. Increment.	6:50 p.m.	8:50 p.m.	1.40	6:54 p.m.	.01	422	. 74 1. 07 . 86 1. 11 . 62 . 25		222	57 1. 82 32 1. 32 11 . 00	1. 321. 571. 821. 88 1. 21 1. 32 1. 32 1. 33 1. 34 1. 34 1. 34 1. 01 . 11 . 00 . 01 . 00 . 01 . 00 . 00	1.33	1.33 1.34 1.34 1.34	.34	12.03	1.371.	1.39 1.40	100			111
San Francisco, Calif	Maximum for period Observed precipitation. Increment.	9:18 p.m.	10:35 p.m.	. 95	9:37 p.m.	. 05	388	28.35	. 59	182 1	32 1. 32 75 . 81 05 . 06	21 1. 32 1. 32 1. 33 70 . 75 . 81 11 . 05 . 06		1.34	. 34		1. 37 1.	1. 39	1 1 1			111
San Juan, P.R. Nov. 11-12, 1931.	Maximum for period Observed precipitation. Increment	1:52 p.m.	(2)	8.06	2:35 р.т.	. 39	82.1.3	<u>868</u>	5828	1832	75 .81 .12 .32	.81 .81 .32 .46	1.51	1.24 .35 .39 .81 .63 .82	86 2. 25 3. 06 3. 69 35 . 39 . 81 . 63	81	63			5.04	6.24	
San Luis Obispo, Calif Feb. 2, 1926.	Maximum for period Observed precipitation, 11:38 a.m. Increment	11:38 a.m.	6:10 p.m.	1.63	5:26 p.m.	. 95	999	291:	34%	2000	. 64 20	6.2	2. 73	7.03	0.00	*	+			1 1	7. 7.	
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Aug. 12, 1922. Sault Ste. Marie, Mich. Aug. 7, 1916. Savannath, Ga. July 10, 1921. July 124, 1931. Searthe, Wash. Aug. 24, 1921. Sheridan, Wyo. July 2, 1912. Sheridan, Wash. Juny 21, 1910. Spokane, Wash. July 23, 1917. Springfield, Mo. Springfield, Mo. Springfield, Mo. Stringfield, Mo. Stringfield, Mo. Stringfield, Mo. Stringfield, Mo. July 23, 1917. Springfield, Mo. Stringfield, Mo.	l'ampa, Fla. June 12, 1900. Tatoosh Island, Wash, Oct. 18, 1914. Taylor, Tex. Apr. 29, 1905. Terre Haute, Ind
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Table 1.--Most intense rainstorm recorded at each station through 1933—Continued

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		Ent	Entire storm		Ē	Fall				Pre	pipita	Precipitation for various periods, in inches	or va	rious	peri	i,spc	n inc	pes			
Station and date	Item	Duration	tion	Rain-	cessive rate	to ex-						Minutes	ites							Hours	23
		From-	То—	fall	педап	rate 1	10	10 1.	15 20) 25	30	35	40	45 5	50 6	08 09	100	120	ಣ	9	12
Thomasville, Ga	Observed precipitation.	2:02 p.m.	5:18 p.m.	<i>In.</i> 4. 49	2:17 p.m.	In. 0.010.210	0.210	0.52 0.64 0.78	64 0.7	0.64 0.78 1.111 68 2.23 2.94 3.88 3.77 4.14 4.26 1.12 1.14 3.38 5.77 5.55 5.71 4.44 3.9 3.37 1.12	1.68	2, 23	. 94 3.	38.3	39	14.2	9879				
June 27, 1909. Toledo, Ohio	Maximum for period Observed precipitation.	7:06 a.m.	8:35 a.m.	3,65	7:14 a.m.	.01	788	120	32 2.	3.1.17 3.4.45	71.74	2.34	5. 30 s. 5. 93 3.	2002	. 88 18 4. 8. 4.	20 4.2	8 ! !				
Aug. 16, 1920.	Maximum for period Observed precipitation.	2:20 p.m.	3:45 p.m.	.52	2:48 p.m.	. 03	99.55	1. 19 1.	39 39	18 2. 6.	2.88	3.08	3. 26 3.	.363.	463.	82	11				11
Sept. 12, 1923.	Maximum for periodObserved precipitation	4:45 a.m.	6:30 p.m.	4.59	5:28 a.m.	90.	61.88	452	34	81.24	1.65	1.96	1.962.322.	14-	2. 79 3. 27	27.3.5	6 3. 7	3.563.703.82	3.99		33
Sept. 14, 1930.	Maximum for period Observed precipitation.	6:35 p.m.	7:15 p.m.	1.70	6:38 p.m.	.01	99.00	1.071	1.38 1.74 1.96 1.32	1, 38 1, 74 1, 98 2, 21 96 1, 32 1, 62 1, 69	1.69	2, 45	2. 69 2. 93	933.	3.023.27	27.3.5	69.7	3. 56 3. 70 3. 82	3.99	4.33	1 00
June 30, 1920.	Maximum for period Observed precipitation.	5:12 p.m.	7:40 a.m.	4.02	5:44 p.m.	02		30.82	571.1	1, 43 1, 62 1, 69 1, 19 1, 94 2, 44 2, 62 2, 74 69, 75, 50, 18, 19	2.44	2.62.2	2.74 2.	79							
July 6, 1915.	Maximum for period Observed precipitation Increment	6:12 p.m.	(2)	2.19	2.19 10:58 p.m.	. 57	561	371 191 63	872.1 251.2	72. 14 2. 34 2. 52 2. 64 2. 51 26 1. 26 1. 38 1. 51 1. 61 01 03 09 13	1.38	2.64	2. 74 2. 79 1. 55	79							
May 12, 1923. Walla Walla. Wash	Maximum for period Observed precipitation- Increment	5:48 p.m.	8:25 p.m.	.85	6:02 p.m.	. 05	325	10179	25 1. 26 36 . 45 13 . 09	1. 26 1. 29 1. 38 . 45 . 53 . 57 . 09 . 08 . 04	1.38	1 1 1 1 1 1 1 1 1	55								
May 25, 1911. Washington, D.C	Maximum for period Observed precipitation Increment	3:10 p.m.	5:40 p.m.	1.82	3:12 p.m.	.01	451	29 141 69	38 48 34 1. £	16 . 53	. 57	. 61									
July 15, 1921. Wausau, Wis.	Maximum for period Observed precipitation.	9:32 a.m.	4:56 p.m.	2.10	9:35 a.m.	.01	8222	1. 1. 25 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	481.1 391.1	20 1.63 1.7 1.33	1.82				1 1 1		111				
Wichita, Kans	Observed precipitation.	11:25 p.m.	8:25 a.m.	2.52	11:30 p.m.	.01		5177	1. 13 1. 3 1. 36 1. 7 59 . 3	2017	1. 90 2. 00 2. 05 1. 17 . 10 . 05	1.902.002.052	020	03	1222	2. 16 2. 25	9 . 08	32.39		1621	
June 14-15, 1931. Williston, N. Dak	Maximum for period Observed precipitation. Increment.	3:10 p.m.	6:10 p.m.	3.05	4:18 p.m.	11.	25.E.E.	34	19 .85 1 19 .32	1. 73 1. 90/2, 00/2, 05/2, 07 . 85 1. 12 1. 50 1. 88/2, 25 . 32 . 27 . 38 . 38 . 37	1. 90 2. 00 2. 05 1. 12 1. 50 1. 88 27 38 38	388.	372.	2. 102. 122. 162. 252. 332. 2. 612. 802. 912. 922. 942. 3. 61. 910. 11 01 02	2.2.5 19.2.2.5	912.9 11.0	227	2.39 2.97 2.03	2. 46		1 1 1
June 9, 1932. Wilmington, N.C Sept. 23, 1923.	Maximum for period Observed precipitation. Increment	1:30 p.m.	4:30 p.m.	3.02	1:32 p.m.	. 01	86.4.4.	761. 971. 521.	131. 372. 40. 562.	19 1, 76 2, 01 2, 44 2, 03 4, 43	22.08.2. 2.60.2. 2.16.2.	08 2, 27 2 60 2, 65 2 16 . 05 60 2, 65 2	. 68 . 68 . 68	77.2.48.2.67.2. 52.68	805	912.9	22.9	4 2. 97			

1For each period indicated, the precipitation shown may have occurred in either the same or a different storm from that in which any other of the precipitations occurred.

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		served precipitation. 2:40 p.m. 5:00 p.m. 2:50 2:42 p.m. 01 ;211,471,021.57[1.95]2.18[2:31]2.40	Increment 21, 26, 55, 55, 55, 58, 23, 13, 09	-				served precipitation. 6:06 p.m. 7:06 p.m. 37 6:19 p.m. 03 13 30 31 32 32 32 32 33 33 34 34	1				
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nem	une 29, 1925.		Wytheville, Va	ug. 2	,	ktor	May 26, 1912.		OWS	dy 1.	,		
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Table 2.—Maximum rates of precipitation at each station, through 1933

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25.04.0				Prec	ipitation	in inche	Precipitation in inches during number of minutes stated $^{ m I}$	number	of minu	tes state	d 1					Hours	
погасто	22	10	15	20	25	30	35	40	45	50	09	08	100	120	က	9	12
Abilene, TexAlbany, N.Y.	0.66	1.14	1.55			2, 27				2.76	1.82	3.17	4. 17	4.42			
Alpena, Mich Amarillo, Tex Anniston, Ala	888	. 94 1. 24	1111	1.29 2.36	1.57		1.60 1.87 3.25	1. 68 1. 93 3. 43	1.77		1.85	2.53	2.61	2.74			
Apalachicola, Fla	.63	1.26	1.56		2.04		2. 47				2. 72	3.17	3.31		4.14		
Atlanta, Ga Atlantic City, N.J Augusta, Ga		1.19	1.65	2011.2 283.8 283.8 383.8	2.10 2.46 2.46	2.1.2.2.2.3.3.2.3.3.2.3.3.3.3.3.3.3.3.3.	2.69 2.89 2.84 2.84	12:25 10:89 10:89	12.33	3.19	2.69	3.23	3.83	4. 29		5.40	
Austin, TexBaker, Oreg	.53	84.	1.25		1.58	1.69	1.76	1.85	1.90	2.00	2.01		2.23			3.56	
Baltimore, Md Benton ville, Ark Binghamton, N. Y	.50	1.39 1.19 .90	1.90 1.45 1.07	1.62	2, 52 1, 72 1, 46	2.69 1.84 1.54	2.87 1.89 1.76	2.13	2, 18	2, 21	2.31	15:25 15:25		2.38	3. 58	4.17	
Birmingham, Ala Bismarck, N.Dak Block Island, R.L. Boise, Idaho. Boise, Idaho.	. 64 . 68 . 38 . 17 . 17	1.13 1.10 .64 .33	1.53 1.38 1.42 1.07	1.83 1.06 1.25 1.29	1.97 1.28 1.28 1.41	2. 26 1. 44 1. 45	2. 59 1. 52 1. 52	1. 99 2. 80 1. 67 1. 54	2, 10 2, 94 1, 80 1, 62 1, 62	2, 27 2, 99 1, 85 1, 63	2.37 3.00 2.11 1.76	3.01	3.04 3.02 2.36 2.00	3.07	3.22	2.72	

Table 2.—Maximum rates of precipitation at each station, through 1933—Continued

				Preci	Precipitation in inches during number of minutes stated	n inches	during	number	of minut	es stated						Hours	
Station	10	10	15	20	25	30	35	40	45	50	09	- 08	100	120	63	9	12
Broken Arrow, Okla Brownsville, Tex Buffalo, N.Y Burlington, Vt Cairo, III.	0.48 .64 .42 .47	0.77 1.28 .70 .85	1.05 1.69 .92 1.32	1, 24 2, 08 1, 00 1, 03 1, 54	1.36 2.46 1.18 1.24 1.66	1,46 2,94 1,34 1,38 1,76	1, 54 3, 26 1, 57 1, 56 1, 86	1.69 3.57 1.68 1.63 2.10	1.78 3.83 1.79 1.73 2.41	1.90 4.19 1.95 1.90 2.71	2, 23 4, 75 2, 22 1, 96 3, 15	2, 86 5, 63 3, 35	3. 10 5. 76 2. 33 3. 61	5.81	3.08		
Canton, N.Y. Cape Henry, Va. Charles Cliy, Iowa. Charleston, S.C. Charlotte, N.C.	24. 26. 26. 63.	1.25 1.25 1.02 1.00	1. 06 1. 80 1. 16 1. 48 1. 30	2.13 1.46 1.87 1.51	1. 49 2. 46 1. 69 2. 16 1. 70	1.73 2.79 1.90 2.36 1.86	1.85 3.11 2.03 1.94	1. 91 3. 42 2. 16 2. 77 2. 04	3. 48 3. 24 3. 04 2. 13	2.33 2.33 2.20	3. 67 2. 48 4. 08 2. 35	2. 70 2. 70 2. 59	6.12	6.62	7.42	8.62	9.03
Chattanooga, Tenn. Cheyenne, Wyo. Cheyenne, Wyo. Chicago University, Ill. Cincinnati, Ohio. Cleveland, Ohio.	.80 .78 .78 .78	1. 23 . 90 . 96 1. 40	1, 51 1, 32 1, 22 1, 78 1, 46	1, 77 1, 63 1, 51 2, 13 1, 77	1. 92 1. 72 2. 47 1. 78	1.85 2.203 1.80 1.80	2.22 22 20 2.60	2, 30	2.46	1.84	2. 52	2.83	2.39			3, 54	
Columbia, Mo Columbia, S.C. Columbia, Onio Concord, N.H. Concord, N.H.	83.55.55	. 99 1. 05 1. 06 1. 06	1. 22 1. 39 1. 31 1. 55 1. 55	1.36 1.60 1.56 1.88 1.68	1. 61 1. 67 1. 80 2. 18 1. 99	1.86 1.86 2.39 2.39	2.2.2.2. 2.2.5.2. 2.2.60	2.21 2.23 2.34 2.69 35	2, 34 2, 19 2, 42 2, 43	2.51	2. 73 2. 79 2. 79	2.84 2.85 2.73	2.98	3. 26 3. 84 2. 93	4.64		
Corpus Christi, Tex Dallas, Tex Davenport, Jowa Dayron, Ohio Del Rio, Tex	.60 .72 .54 .62 .62	1, 14 1, 29 1, 00 1, 00 1, 08	1. 44 1. 54 1. 38 1. 00 1. 58	1.78 1.59 1.33 2.08	2. 18 2. 07 1. 61 1. 54 2. 41	2, 38 2, 40 1, 88 1, 75 2, 74	2, 60 2, 71 2, 73 3, 23	2. 88 2. 88 2. 42 1. 83 3. 71	3. 08 2. 2. 2. 08 4. 1. 03	3. 22 3. 17 2. 69 4. 39	3. 63 3. 25 2. 26 4. 67	3.82 3.35 2.52 5.07	3.38	3.65	4, 54	6.03	
Denver, Colo. Dos Moines, Iowa Detroit, Mich Devils Lake, N. Dak Dodge City, Kans.	. 87 . 62 . 78 . 90 . 55	1, 20 1, 10 1, 37 1, 45 1, 02	1.52 1.33 1.81 1.84 1.34	1. 62 1. 53 2. 06 2. 18 1. 55	1. 67 1. 67 2. 21 2. 24 1. 86	1.72 1.74 2.36 2.40 2.21	1. 99 2. 46 2. 54 2. 50	2, 22 2, 51 2, 51 2, 64 2, 81	1,80 2,29 2,29 2,95 95	1. 93 2. 32 2. 60 3. 11	2. 20 2. 62 2. 98 2. 70 3. 47	2. 32 3. 05 3. 47 4. 27	3. 29 3. 78 4. 85	3.32	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Drexel, Nebr Dubuque, Jowa Due West, S.C Duluth, Minn Eastport, Maine	. 50 . 56 . 56 . 54 . 54	1.20 1.09 1.09 98 75	1, 15	1.36 1.74 1.84 1.38	1. 47 1. 99 2. 25 1. 48 1. 10	1. 60 2. 23 2. 53 1. 60	1.80 2.40 2.74 1.71 1.16	1. 94 2. 51 2. 95 1. 80 1. 25	2. 06 2. 64 3. 15 1. 96 1. 34	3.30	2. 66 3. 45 2. 26	2. 97 3. 91 2. 51 1. 46	2. 47 4. 15 1. 62	2, 89 3, 21 4, 64	1.94	2.85	

			3.45				
3.18		11.79		6.59		5.20	3.62
4.69			1.72		3.97	4.09	3.92
3.14	3.01	4.32	1.62	2.84	4. 28	3.10	3. 11 7. 09 3. 30
3.07	2.70	3.95	2.39	3, 52 2, 63	3.80	3.08	2.0.6.2.7. 2.0.6.2.7. 7.0.6.2.7. 7.0.6.2.7.
2. 47 2. 78 2. 25	2.31	3.66	2.28 1.61 4.03	3. 21 2. 44 5. 52 1. 30	3.29	2.86 3.22 3.41 4.15	2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,
2.62	2.79	3.08 5.31 1.67	1. 59 3. 42 3. 35	2. 94 2. 92 5. 26 1. 19	2, 50 2, 61 3, 59 2, 12	2. 66 3. 21 3. 83	1.92 1.92 1.92 1.92
2. 32 2. 50 1. 38 1. 97	2. 59	2.89	2. 19 2. 16 1. 57 3. 34 2. 99	22.2.3.4 28.80 98.90 93.80	2.28 3.54	2.56 2.65 3.00 3.66	2. 3.7 2. 5.7 2. 5.7 1. 82
2. 28 2. 45 1. 30 1. 83	2.41	2.66	2, 11 2, 10 1, 56 2, 16 2, 75	2. 69 2. 32 2. 81 4. 61	2. 25 2. 10 3. 47	2. 85	2.28 3.77 1.254 1.76
2. 22 2. 16 1. 78	2.23	3.72	2.01 2.08 2.91 2.91 2.48	2. 51 2. 21 2. 69 4. 07	2.08 2.08 1.87 3.33	2. 18 2. 63 2. 73 3. 17	3, 79 2, 15 3, 47 1, 59
2.11 1.96 1.72 1.87	1.99	3.27	1, 86 2, 03 2, 51 2, 60 2, 18	2, 15 2, 09 2, 44 3, 51	1.95 2.10 3.10 2.04	2. 05 2. 46 2. 60 2. 86	3.45 2.04 3.10 2.36
1.95 1.82 1.26 1.55 1.77	. 63 1.81 1.15 1.73 2.01	2. 02 1. 16 2. 82 1. 43 . 64	1, 71 1, 81 1, 48 2, 30 1, 96	1.90 1.95 2.32 3.04	1.79 2.92 1.98	1. 98 2. 27 2. 46 2. 55	3.07 1.92 2.66 1.53
1.73 1.24 1.45 1.65	1.59 1.59 1.06 1.52 1.83	1. 91 1. 12 2. 50 1. 28	1.51 1.59 1.42 1.98 1.74	1.86 1.64 2.05 2.61	1. 58 1. 35 1. 35 1. 89	1. 78 2. 02 2. 26 2. 26	2.65 1.78 2.30 1.50 1.51
1. 38 1. 06 1. 38 1. 38 1. 62	1.36 .96 1.29 1.48	1.71 1.06 2.24 1.04 .61	1.31 1.36 1.22 1.87 1.53	1. 63 1. 56 1. 66 2. 20 . 88	1. 33 1. 16 2. 26 1. 74	1.54 1.70 1.95 1.87 .95	2. 15 1. 57 1. 93 1. 64 1. 41
1.05 1.37 .87 1.28 1.52	51 1.15 85 1.13 1.24	1.40 .82 1.92 .89	1. 10 1. 06 1. 68 1. 68 1. 34	1. 33 1. 44 1. 43 1. 72	. 76 1. 09 2. 00 1. 47	1.28 1.60 1.63 1.55	1. 65 1. 30 1. 49 1. 31 1. 31
. 81 1.11 . 65 . 98 1.32	.85 .64 .90	. 97 1. 45 1. 72 . 54	. 89 . 80 . 80 1. 31 1. 01	. 98 1. 30 1. 10 1. 21 . 67	. 60 . 79 . 79 1. 43 1. 14	1. 08 1. 37 1. 16 1. 10 . 70	1. 12 1. 05 1. 05 . 99 . 99
55. 64. 65. 66. 66.	. 21 . 48 . 35 . 50 . 79	. 56 . 34 . 42 . 30	. 48 . 51 . 54 . 58 . 58	1.04 1.04 1.65 1.65 1.37	74.4.8.8.7.7.8.4.8.7.7.7.8.4.8.7.7.7.8.4.8.7.7.7.7	69. 72. 72. 44.	.80 .65 .54 .66
Elkins, W.Va Ellenfale, N. Dak El Paso, Tex. Brie, Pa Escabana, Mich.	Bureka, Calif. Evansville, Ind Fligstaff, Arix. Fort Smith, Arix. Fort Wayne, Ind	Fort Worth, Tex. Fresno, Calif. Galveston, Tex. Grand Haven, Mich. Grand Junction, Colo.	Grand Rapids, Mich. Green Bay, Wis. Greensboo, N.C. Greensbeck, Tex.	Hannibal, Mo- Harrisburg, Pa- Hartford, Conn- Hatters, N. C. Havre, Mont.	Helena, Mont Honolulu, Hawaii Honghton, Mich Houston, Tex Huron, S. Dak	Indianapolis, Ind Clola, Kans. Jacksonville, Fla Jupiter, Fla Kalispell, Mont.	Kansas City, Mo Keokuk, Iowa Key Week, Fla Knovville, Tenn LaCrosse, Wis

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Table 2.—Maximum rates of precipitation at each station, through 1933—Continued

				Preci	itation i	n inches	during	Precipitation in inches during number of minutes stated	of minu	tes state	-					Hours	
Station	7.0	10	15	20	25	30	35	40	45	20	09	08	100	120	60	9	12
Lander, Wyo	0.45	00.75	1.02	1.16	1.24	1.31	1.39	1.40	1.41	1.42	1.43	1.45	1 97	1.46	2, 29	1.51	
Lewiston, Idaho	888	1.13	1.54	1.83	2, 10			2.85	2.96	3.09	3.20	3.26	3.79	5.15	6.17		
Little Rock, Ark	.58	1.24	1. 70	1.53	1.68	2, 53	2. 78	25.53	2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	3.06	3.08	2.61	2.93	3, 57	3, 88		
Louisville, Ky	25.	1.11	1. 10	1.55	1.38								2.84	3.22	3.75		
Lynchburg, Va. Macon, Ga. Madison, Wis. Marquette, Mich.	929.636	1.06	1.51	1.89 1.96 1.61	2.03 1.88 1.42	2. 13 2. 09 1. 67	22.29	25.25 25.25 25.25 25.25 26.45	2,6,2,2,2,2,3,2,3,2,3,3,3,3,3,3,3,3,3,3,	3. 15 2. 25 2. 50	3. 4. 3. 4. 2. 2. 2. 9. 4. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9.	3.54		6.54			
Menphis, Jenn Meridian, Miss Miami, Fla	. 67	1.05	1.52	1.90									5.12	5.68			
Miles City, Mont	.54.8	. 94	. 81 1. 35 1. 16	1.32	1.71	1.86	1.97	2.06	2.12	2.20		2.67.	3.07	3.24			
Mobile, Ala. Modena, Utah. Montgomery, Ala. Moorhead, Mina. Mount Tamalpais, Calif.	. 73 . 38 . 61 . 68	1. 33 . 68 1. 04 1. 02	1. 54 . 95 1. 47 1. 37	1.89 1.06 1.65 1.45	2, 22 2, 15 1, 90 . 50	2. 31 1. 12 2. 49 1. 56	2.36 1.17 2.68 1.82 .59	1. 22 2. 86 1. 98 . 65	2. 50 1. 24. 3. 08 2. 13	2. 62 1. 27 3. 29 2. 26	3. 02 1. 41 3. 46 2. 55	3.90 1.68 3.55 2.60	4.32	4.47	5.40	5.81	
Mount Weather, Va. Nantueket, Mass. Nashville, Tenn. New Haren, Conn. New Orleans, La.	55. 180 178 178	. 85 . 69 1. 19 1. 27 1. 19	1.14 .81 1.33 1.77 1.68	. 99 1. 49 2. 26 1. 97	1. 19 1. 18 1. 65 2. 32 2. 23	1. 33 1. 34 1. 72 2. 37	1. 68 1. 41. 1. 79	1. 68 1. 86 2. 59	1. 74 1. 94 1. 93 2. 97	1. 88 2. 19 2. 33 3. 22	2. 14 2. 31 3. 66	2. 62 2. 42 2. 68 3. 77	3.09	3.11	6.54		
New York City, N.Y. Norfolk, Va. Northfield, Vt. North Head, Wash. North Platte, Nebr.		1. 20 . 99 1. 46 . 32	1. 63 1. 35 1. 38 1. 02	1. 93 1. 57 1. 71 1. 21	2. 14 1. 66 1. 74 1. 39	2.31. 1.75 1.80 1.69	2. 41 1. 96 1. 89 1. 57 1. 99	2. 46 1. 91 2. 19	2.22	2. 52	2.69	3. 26	3. 20 4. 44 2. 16 3. 52	3.50 2.28 2.28 3.77	1.04	1.45	

	-,			~	3,0 ===	,		_
3.85		6.52	2. 58		7.10	6.31		6.24
4.12	7.10	1.98	3.09	4.65	7.01	4.92	3.74	5.04
3.00 1.95 3.79	6. 10 5. 43 1. 79	1.92	1.97	3.98 4.89 3.72	6.32	4.06	4. 61 2. 09 2. 82 2. 39	4.67
3.69 1.87 3.35 2.43	5.08 5.35 2.25	3.73	3.02	3.71 4.35 3.31 86	5.61	3. 68 2. 93		4.51
3. 63 2. 61 2. 18	4. 49 2. 68 4. 82 1. 68	1.81	1.73	3.41 3.58 2.80	5. 07 2. 74 2. 64	1.26 3.13 3.65 2.69		4. 14
3. 23	4. 27 2. 60 3. 79 1. 30 1. 93	.98	2.46	2. 41 2. 68 2. 07	4. 02 2. 49 2. 21 2. 21	2. 97 3. 47 2. 60		2. 31 3. 44 1. 07 1. 16
2.33	4. 15 2. 57 3. 30 1. 81	1.75	2.10	2. 99 2. 03 1. 82 1. 82	3. 34 2. 24 1. 92 2. 08	2.67 3.31 2.41	2.68	3,05
2.21	4.01 2.52 2.87 1.72	1. 65 1. 16 . 79	2. 32 1. 20 1. 92 1. 94	2.94 1.85 2.28 1.66	3. 12 2. 12 1. 79 1. 94	2. 48		2.89
2. 65 2. 05 1. 52 2. 81	3.94 2.45 2.67 1.28 1.57	1. 64 1. 09 . 71 2. 99	2. 28 1. 78 1. 83	2.87 1.69 2.20 1.52	2.90 1.98 1.70	2. 19 2. 31 2. 31	2, 49 . 88 2, 65 2, 11	2.73 2.73 1.10
2. 55 1. 91 1. 44 1. 98 1. 98	3.80 2.32 2.47 1.25	1.48 1.05 1.05 2.85	2.10 1.16 1.71 1.72	2. 76 1. 60 2. 11 1. 35	2. 71 1. 84 1. 62 1. 62			2. 59 1. 02 1. 02
2. 29 1. 71 2. 47 1. 91	3.65 2.10 2.24 1.16 1.52	1. 46 . 95 . 53 2. 76	1. 86 1. 10 1. 59 1. 59	2.57 1.45 2.05 1.21	2. 60 1. 70 1. 46 1. 56	. 79 1.82 2.50 2.12		1. 56 . 81 2. 25 . 71
2.00 1.63 2.22 1.76	3.37 1.80 1.92 1.11 1.11	1.43	1.60 1.05 1.47 1.42	2.35 1.35 1.92 1.05	2. 32 1. 56 1. 37 1. 43.	. 67 1. 63 2. 07 1. 90	1. 97 1. 91 2. 04 1. 59	1.32
1. 47	2.88 1.50 1.62 .99 1.38	1.36 .69 .51	1.35 1.29 1.29	2. 01 1. 16 1. 74 1. 74 . 89	2. 07 1. 26 1. 14 1. 33 1. 26	1. 22 1. 38 1. 70 1. 69	1.70 1.75 1.75 1.34	1.21
1. 43 1. 27 1. 28 1. 54 1. 52	2. 29 1. 20 1. 35 1. 24	1. 23 . 61 . 47 1. 60	1.05 1.52. 1.09 1.09	1.71 .95 1.39 .76	1. 63 1. 10 1. 17 1. 17		1. 46 1. 35 1. 35 1. 10	1.15
. 91 1. 21 1. 08 1. 14	1.53 .94 .60 1.06	.97 .36 .30 1.13	. 74 1.41 . 63 . 76 . 80	1.35 .73 .98 .51	1.28 .80 .80 .80	. 94 . 94 1.00 . 98	1.12 1.12 1.47 1.87	1.02 1.02 1.55
		58425	1.06	. 73 . 59 . 39 . 30	555.55	27 62 88 58 58 58	230	
Oklahoma City, Okla Omaha, Nebr Osvege, N. Y Palestine, Tex Parkersburg, W.Va.	Pensacola, Fla. Peoria, III. Philadelphia, Pa. Phoenx, Ariz. Piere, S.Dak.	Pittsburgh, Pa Pocatello, Idaho Poitt Reyes Light, Calif. Port Angeles, Wash Port Arthur, Tex.	Port Huron, Mich Portland, Maine- Portland, Oreg Providence, R. I. Pueblo, Colo	Raleigh, N.C. Rapid City, S.Dak Reading, Pa. Red Bluff, Calif.			Salt Lake City, Utah San Autonio, Tex. San Diego, Calif Sand Key, Fla Sandusky, Ohio.	Sandy Hook, N.J. San Francisco, Calif. San Juan, P. R. San Luis Obispo, Calif. Santa Fe, N. Mex

Table 2.—Maximum rates of precipitation at each station, through 1933—Continued

				Pred	ipitation	in inch	es during	Precipitation in inches during number of minutes stated	of min	tes state	þí					Hours	
Station	70	10	15	50	25	30	35	40	45	20	09	- 08	100	120	က	9	12
Sault Ste Marie, Mich	0.61	0.85	0.92	0.94	1.01				1, 12	1, 15							
Savannah, Ga	. 65	1.08	1. 49	1.90	2.07	1.83	2.57	1.99	3.00	3, 19	3. 40 2. 16	3.82	2. 64 2. 64	2.70		1 1	
Seattle, Wash Sheridan, Wyo	. 59	94.69	. 51	- 99	1. 22		1.33	1.34	1.36	1.38	1.39	1.84	2.40	2.68		0.65	
Shreveport, La	. 69	1.24	1.73	1.80	1.87	2.00	8.23	2. 43	2.57	2.72	3.15	3.61	4.28	5. 19	6, 49		1 1
Spokane, Wash-Springfield, III.	888	1.02	1.41	1.67	1.92					2, 70	2.75	2.51	2.92	3.25	3.35		
Syracuse, N.Y	. 57	.84	1.06	1.38		1.83	. 1	1.97	2.04	2. 28	2,65	3, 15	3, 53	3, 73	1		
Tacoma, Wash Tampa, Fla. Tatoosh Island, Wash Taylor, Tex	1.05	1.66	2. 03 2. 03 2. 30	2. 17 2. 17 . 88 2. 75	2.35 1.00 2.83	2.72	2.95	3.11	3.31	3.49	3.76 1.42 4.22	4.41 1.66 4.88	1.79	4. 42 1. 89 7. 51	4. 58 2. 16 10. 34	2.28	
Terre Haute, IndThomasville, Ga	1.05	1.32	1.38	1. 56 2. 27 2. 18	1. 70 2. 66 2. 61	2.99	3. 13 3. 13 3. 08	3.3.5	3, 2, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 3, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,	3. 46 3. 77 3. 46	2, 57 4, 14 3, 58	4. 26		3.13	5.16	3.46	
Tonopah, Nev		1.07										3.56	3.70	3.82	3.99	4.33	
Trenton, N.J. Valentine, Nebr. Vicksburg, Miss. Walla Walla, Wash.	. 56 . 75 . 74	1.19	1.13	1. 43 1. 73 1. 73	22.33	22.52	2. 64	2. 74	2.79	2.94	3.01	2. 16 3. 21 3. 27	2.30	4.12	5.76	25.0	
Wausau, Wis	. 12·	1. 21	1. 27		1.63										4.08		
Wichita, Kans. Williston, N.Dak. Wilmington, N.C. Winnemucca, Nev.	65.52	1. 10 . 91 1. 07 . 53	1. 47	2.01	1.90	2,298	2. 18	12121 1848 1888	2.36	2.59	2.91	2.89	2.94	2.97	3.05		
Wytheville, Va Yankton, S. Dak Yellowstone Park, Wvo	.75	1. 13	1.48	1.74	1.97	2. 18	2.31	2.40	1.90	2.02	2. 43	3.00			1 1 1		
												-					

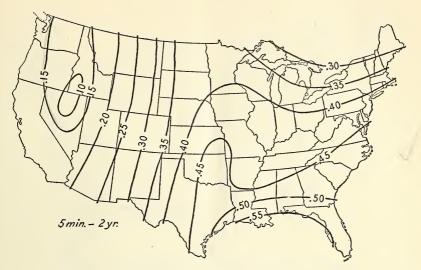


FIGURE 4.—Five-minute rainfall, in inches, to be expected once in 2 years.

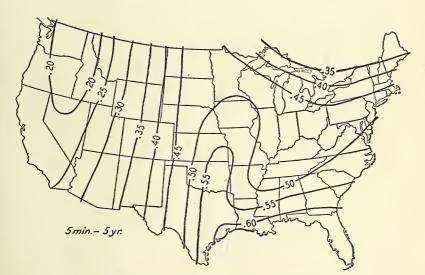


FIGURE 5.—Five-minute rainfall, in inches, to be expected once in 5 years.

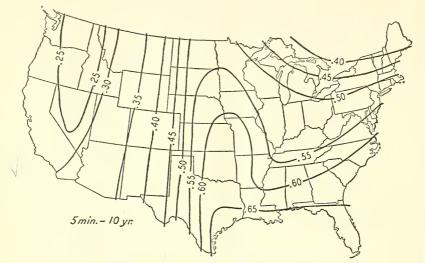


FIGURE 6.—Five-minute rainfall, in inches, to be expected once in 10 years.

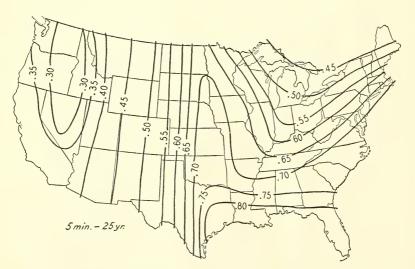


FIGURE 7.—Five-minute rainfall, in inches, to be expected once in 25 years.

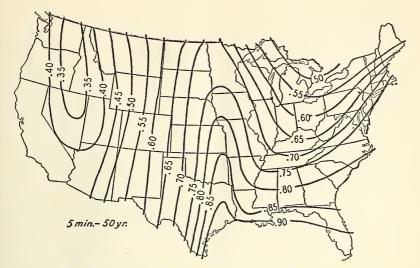


FIGURE 8.—Five-minute rainfall, in inches, to be expected once in 50 years.

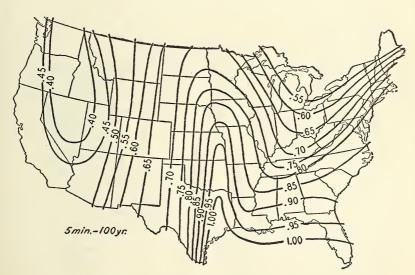


FIGURE 9.—Five-minute rainfall, in inches, to be expected once in 100 years.

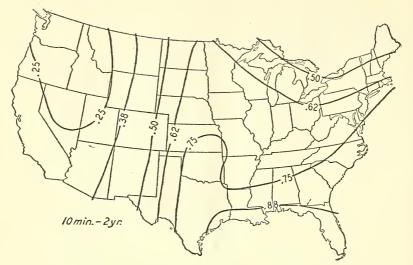


FIGURE 10.—Ten-minute rainfall, in inches, to be expected once in 2 years.

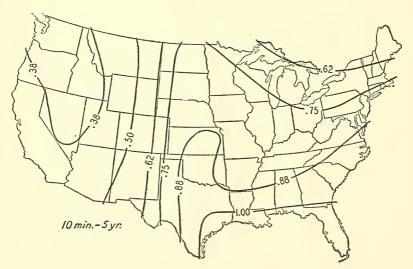


FIGURE 11.—Ten-minute rainfall, in inches, to be expected once in 5 years.

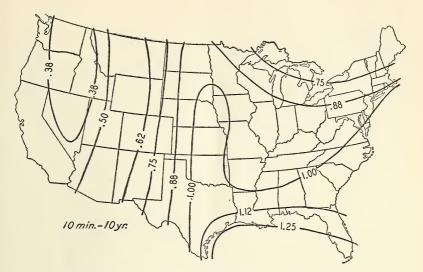


FIGURE 12.—Ten-minute rainfall, in inches, to be expected once in 10 years.

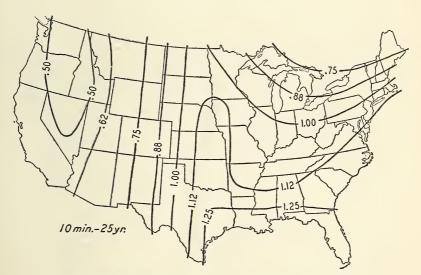


FIGURE 13.—Ten-minute rainfall, in inches, to be expected once in 25 years.

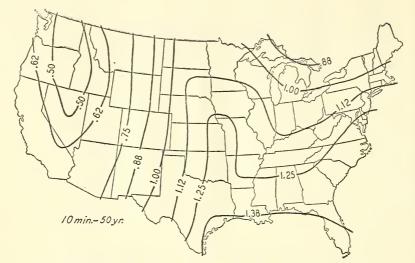


FIGURE 14.—Ten-minute rainfall, in inches, to be expected once in 50 years.

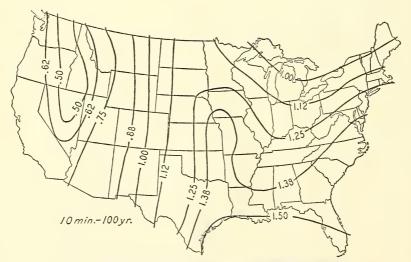


FIGURE 15.—Ten-minute rainfall, in inches, to be expected once in 100 years.

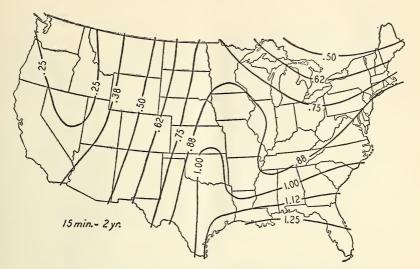


FIGURE 16.—Fifteen-minute rainfall, in inches, to be expected once in 2 years.

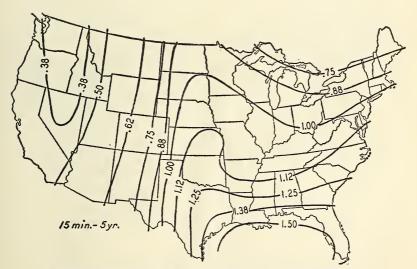


FIGURE 17.—Fifteen-minute rainfall, in inches, to be expected once in 5 years.

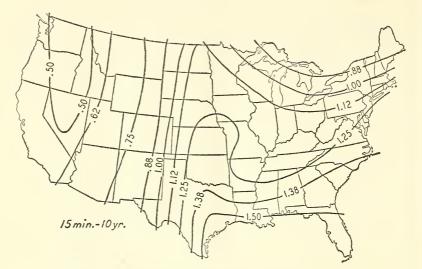


FIGURE 18.—Fifteen-minute rainfall, in inches, to be expected once in 10 years.

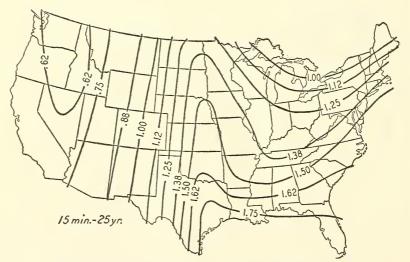


FIGURE 19.—Fifteen-minute rainfall, in inches, to be expected once in 25 years.

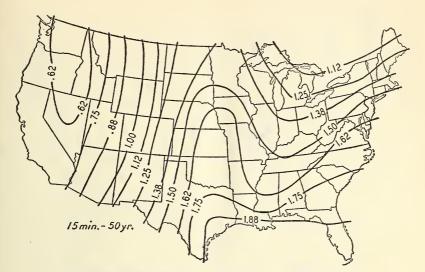


FIGURE 20.—Fifteen-minute rainfall, in inches, to be expected once in 50 years.

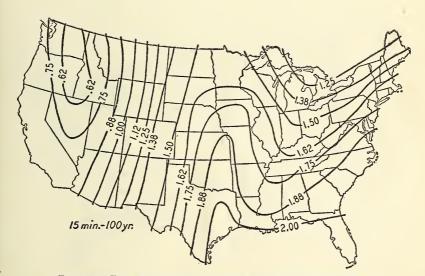


FIGURE 21.—Fifteen-minute rainfall, in inches, to be expected once in 100 years.

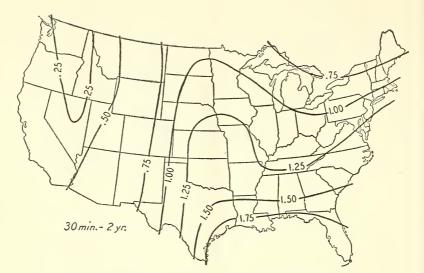


FIGURE 22.—Thirty-minute rainfall, in inches, to be expected once in 2 years.

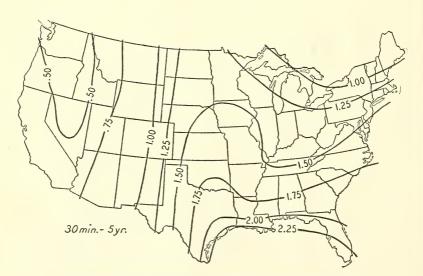


FIGURE 23.—Thirty-minute rainfall, in inches, to be expected once in 5 years.

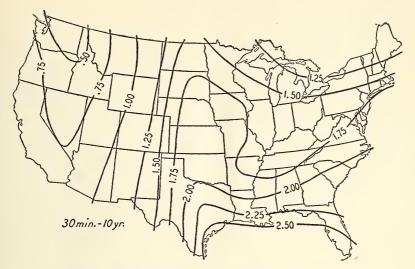


FIGURE 24.—Thirty-minute rainfall, in inches, to be expected once in 10 years.

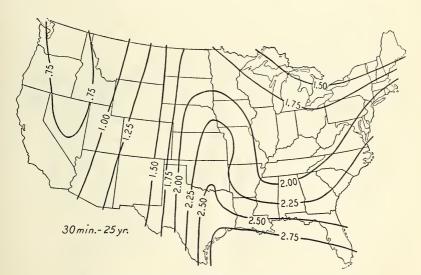


FIGURE 25.—Thirty-minute rainfall, in inches, to be expected once in 25 years.

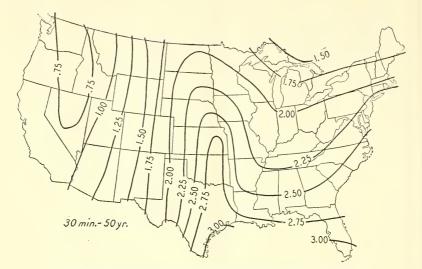


FIGURE 26.—Thirty-minute rainfall, in inches, to be expected once in 50 years.

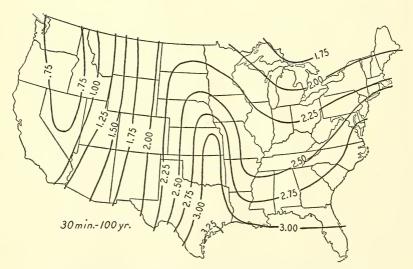


FIGURE 27.—Thirty-minute rainfall, in inches, to be expected once in 100 years.

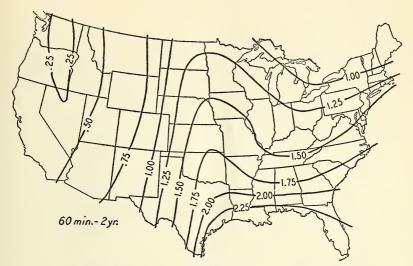


FIGURE 28.—One-hour rainfall, in inches, to be expected once in 2 years.

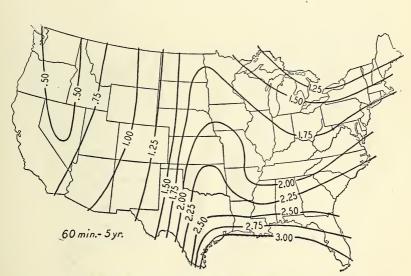


FIGURE 29.—One-hour rainfall, in inches ,to be expected once in 5 years.

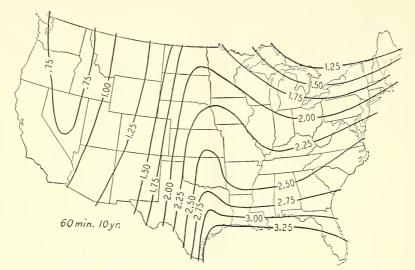


FIGURE 30.—One-hour rainfall, in inches, to be expected once in 10 years.

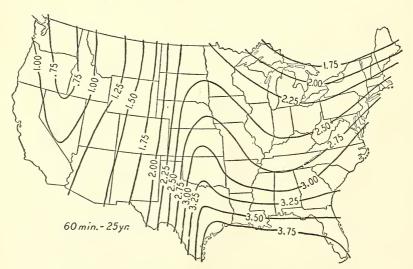


FIGURE 31.—One-hour rainfall, in inches, to be expected once in 25 years.

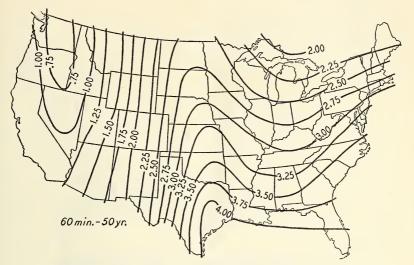


FIGURE 32.—One-hour rainfall, in inches, to be expected once in 50 years.

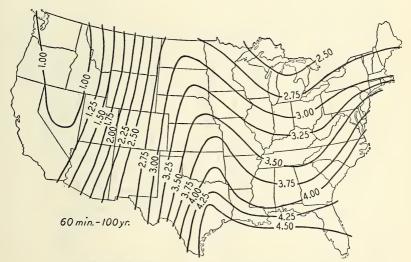


FIGURE 33.—One-hour rainfall, in inches, to be expected once in 100 years

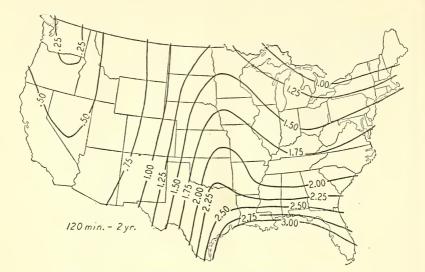


FIGURE 34.—Two-hour rainfall, in inches, to be expected once in 2 years.

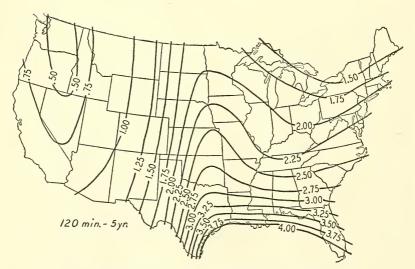


FIGURE 35.—Two-hour rainfall, in inches, to be expected once in 5 years.

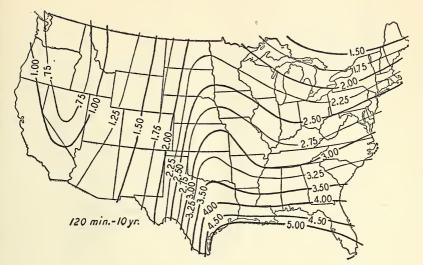


FIGURE 36.—Two-hour rainfall, in inches, to be expected once in 10 years.

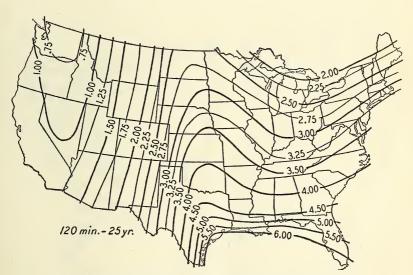


FIGURE 37.—Two-hour rainfall, in inches, to be expected once in 25 years.

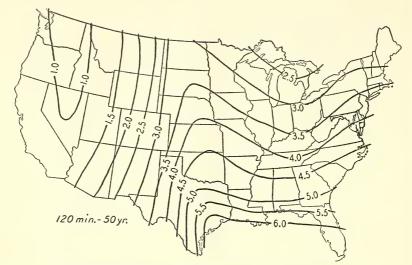


FIGURE 38.—Two-hour rainfall, in inches, to be expected once in 50 years.

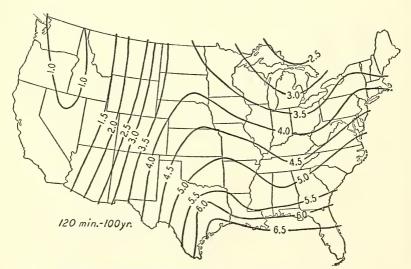


FIGURE 39,-Two-hour rainfall, in inches, to be expected once in 100 years.

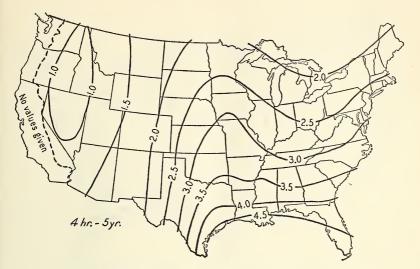


FIGURE 40.—Four-hour rainfall, in inches, to be expected once in 5 years.

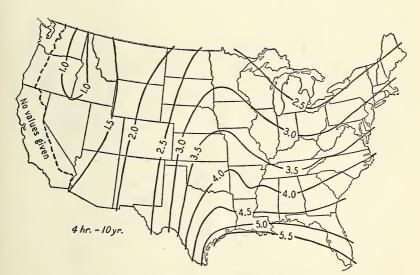


FIGURE 41.—Four-hour rainfall, in inches, to be expected once in 10 years.

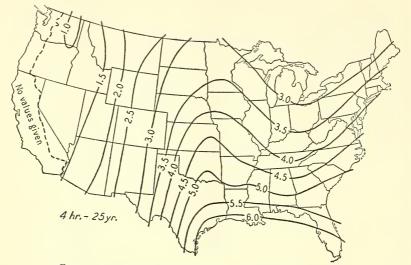


FIGURE 42.—Four-hour rainfall, in inches, to be expected once in 25 years.

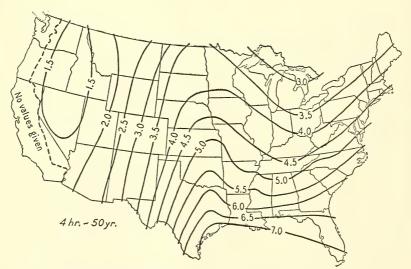


FIGURE 43.—Four-hour rainfall, in inches, to be expected once in 50 years.

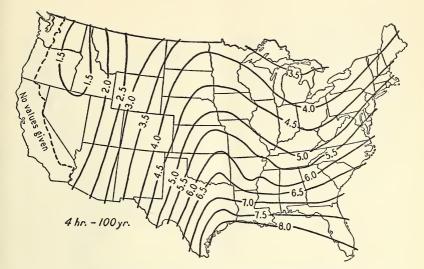


FIGURE 44.—Four-hour rainfall, in inches, to be expected once in 100 years.

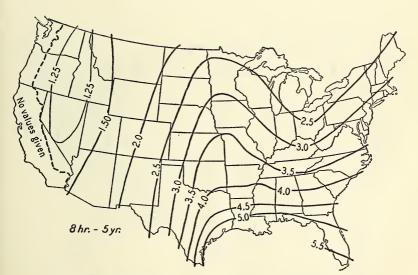


FIGURE 45.—Eight-hour rainfall, in inches, to be expected once in 5 years.

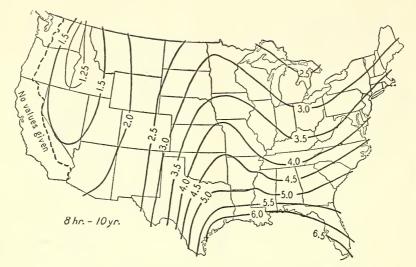


FIGURE 46.—Eight-hour rainfall, in inches, to be expected once in 10 years.

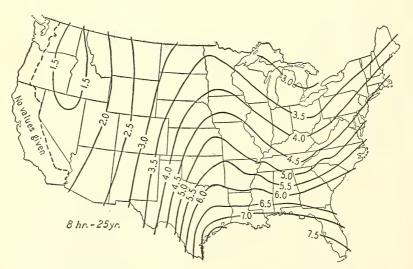


FIGURE 47.—Eight-hour rainfall, in inches, to be expected once in 25 years.

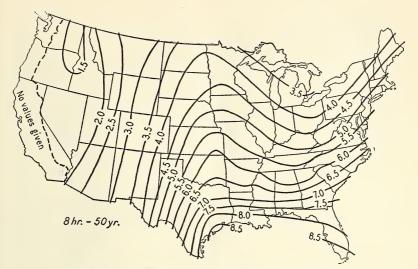


FIGURE 48.—Eight-hour rainfall, in inches, to be expected once in 50 years.

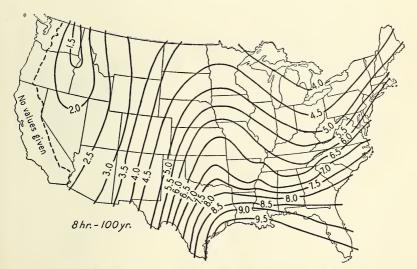


FIGURE 49.—Eight-hour rainfall, in inches, to be expected once in 100 years.

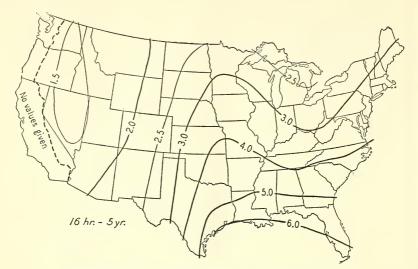


FIGURE 50.—Sixteen-hour rainfall, in inches, to be expected once in 5 years.

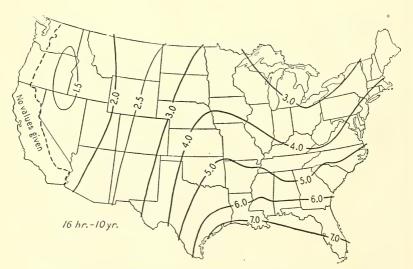


FIGURE 51.—Sixteen-hour rainfall, in inches, to be expected once in 10 years.

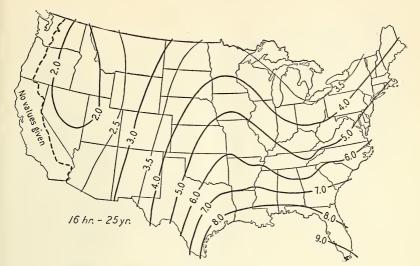


FIGURE 52.—Sixteen-hour rainfall, in inches, to be expected once in 25 years.

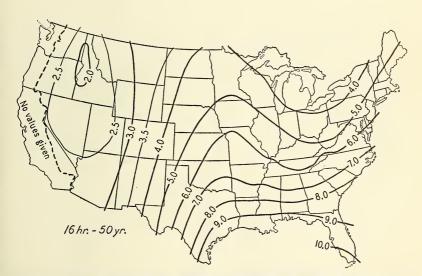


FIGURE 53.—Sixteen-hour rainfall, in inches, to be expected once in 50 years.

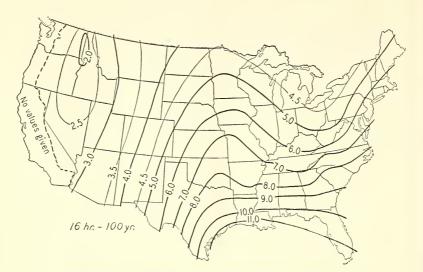


FIGURE 54.—Sixteen-hour rainfall, in inches, to be expected once in 100 years.

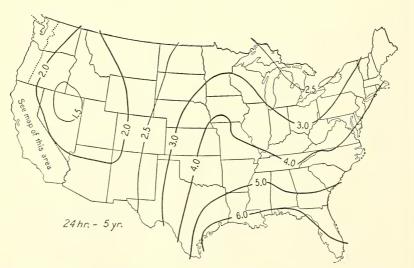


FIGURE 55.—Twenty-four-hour rainfall, in inches, to be expected once in 5 years. (Data for Pacific Coast area are given in fig. 60.)

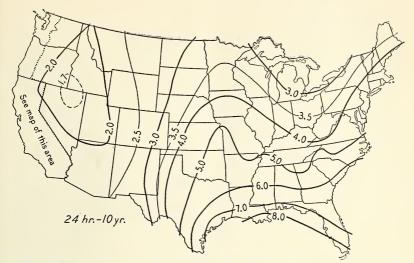


Figure 56.—Twenty-four-hour rainfall, in inches, to be expected once in 10 years. (Data for Pacific Coast area are given in fig. 60.)

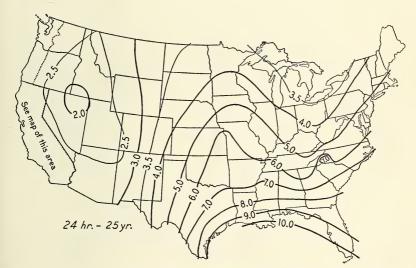


FIGURE 57.—Twenty-four-hour rainfall, in inches, to be expected once in 25 years. (Data for Pacific Coast area are given in fig. 61.)

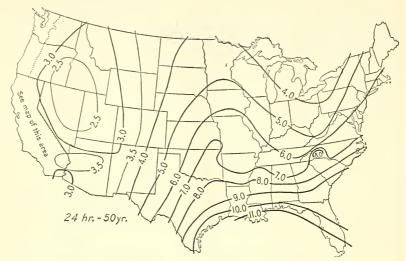


FIGURE 58.—Twenty-four-hour rainfall, in inches, to be expected once in 50 years. (Data for Pacific Coast area are given in fig. 61.)

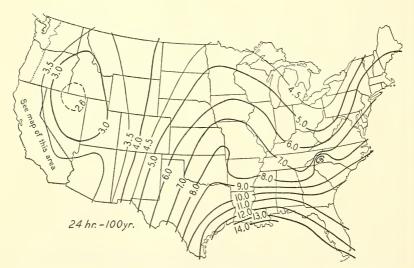


FIGURE 59.—Twenty-four-hour rainfall, in inches, to be expected once in 100 years. (Data for Pacific Coast area are given in fig. 62.)

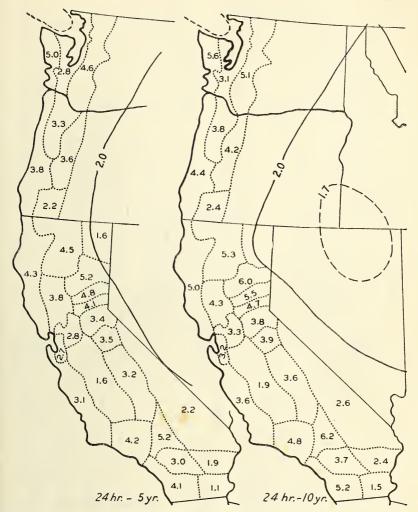


FIGURE 60.—Twenty-four-hour rainfalls in the Pacific Coast district, in inches, to be expected once in 5 years and once in 10 years.

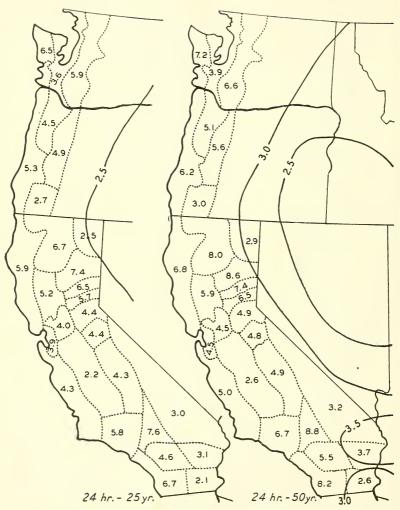


Figure 61.—Twenty-four-hour rainfalls in the Pacific Coast district, in inches, to be expected once in 25 years and once in 50 years.

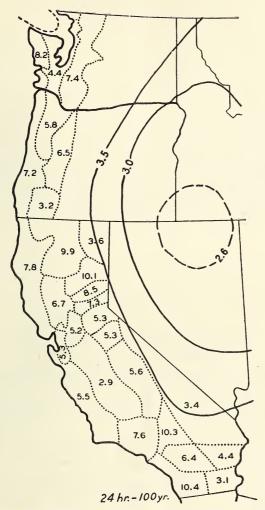
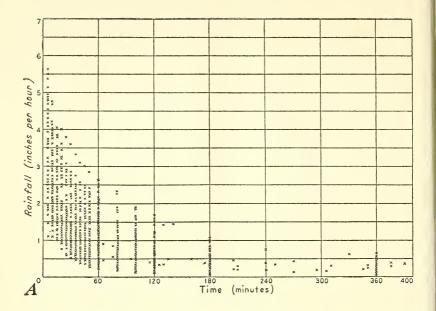


FIGURE 62.—Twenty-four-hour rainfall in the Pacific Coast district, in inches, to be expected once in 100 years.



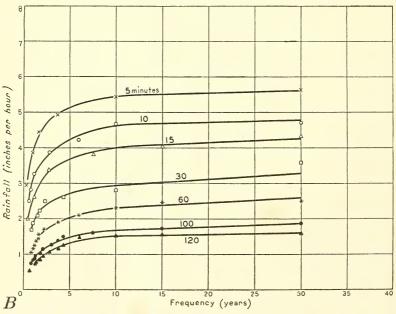
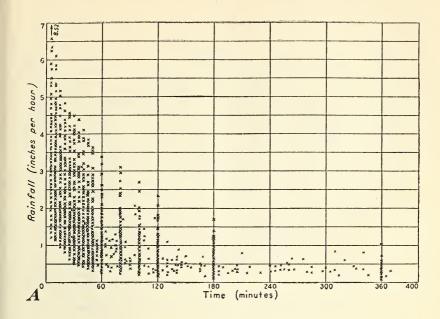


FIGURE 63.—Excessive precipitations at Honolulu, T. H., 1904-33. A, Record of rates and durations; B frequency of occurrences.



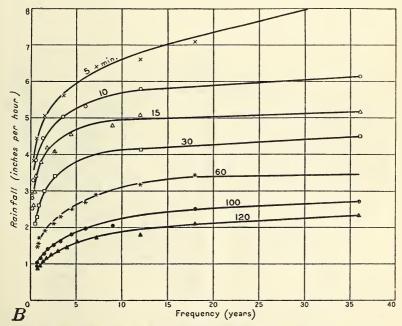


Figure 64.—Excessive precipitations at San Juan, P. R., 1898-1933. A, Record of rates and durations; B frequency of occurrences.



FIGURE 65.—Number of excessive rainstorms in January, per 30 years,

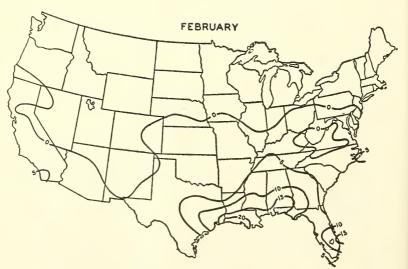


Figure 66.—Number of excessive rainstorms in February, per 30 years,



FIGURE 67.—Number of excessive rainstorms in March, per 30 years.



FIGURE 68.—Number of excessive rainstorms in April, per 30 years.

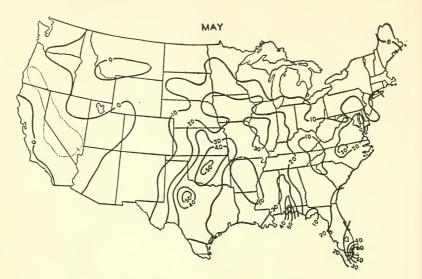


FIGURE 69.—Number of excessive rainstorms in May, per 30 years.

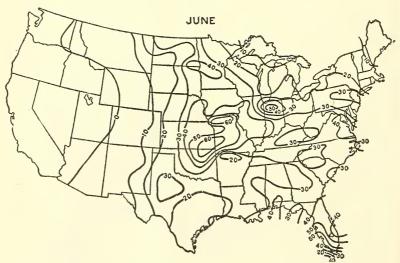


FIGURE 70.—Number of excessive rainstorms in June, per 30 years.

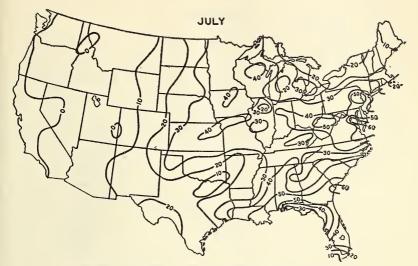


FIGURE 71.—Number of excessive rainstorms in July, per 30 years.

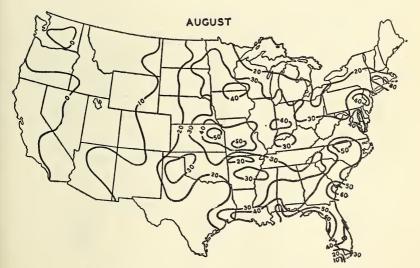


FIGURE 72.—Number of excessive rainstorms in August, per 30 years.



FIGURE 73.—Number of excessive rainstorms in September, per 30 years.



FIGURE 74.—Number of excessive rainstorms in October, per 30 years.



FIGURE 75.—Number of excessive rainstorms in November, per 30 years.



Figure 76.-Number of excessive rainstorms in December, per 30 years.

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